THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXII. No. 24. Whole No. 1,566. | NEW YORK, MONDAY, JUNE 12, 1905. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them. All payments to be made in advance. Single copies, 10 cents.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs).

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Respecting the Official Work of the American Gas Light Association..... 921

NOTICES—
The July Meeting of the Pacific Coast Gas Association..... 921

EDITORIALS—
Briefly Told..... 921
Death of Mr. William T. Lees—Members of the State Lighting Commission—Notes.
Twenty-eighth Annual Meeting, Western Gas Association—Official Report—Revised by the Secretary—Continued from page 884.... 922
First Day, Morning Session—*Cement Joints, by Mr. J. D. von Maur.
*Samples of Coal as Shown by Retail Coal Dealers, by "G. D. R." 928
Notes on the Use of Rare Earths in Electric Illuminants, by Mr. M. C. Beebe..... 929
The Besemfelder Process for the Direct Gasification of Coal..... 931
Electricity and Fire Insurance, by Mr. A. H. Mayes..... 932
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 932
Gas for Salisbury, Pa.—We Were Wrong—Annual Meeting, Middletown, N. Y.—Mr. J. H. White Goes to Winona, Minn.—Contract for the Western Gas Construction Company—Cheaper Gas for Moline, Ills.—Cocoanut Oil for Gas Making—An Enjoyable Time, Denver, Col.—Acetylene Gas for Pass Christian, Miss.—Gas at Ocean Grove, N. J.—Something from Los Angeles, Cal.—Mr. George Carson in Control at Washington, Ia.—Cheaper Gas for Waynesboro, Pa.—Cheaper Gas for Malden, Mass.—The "Purists" and the Proposed Philadelphia Gas Lease—And Other Items.
The Market for Gas Securities..... 934

[OFFICIAL NOTICE.]

Respecting the Official Work of the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
SECRETARY'S OFFICE,
530 Broadway, N. Y., Dec. 13, 1904.

To the Members American Gas Light Association: As there seems to be some misunderstanding respecting the standing of the official management of the Association, members will please note that the undersigned is the Secretary of the Association, and that Mr. A. E. Forstall is carrying forward the work of the Practical Class. All correspondence in connection with the Practical Class should therefore be addressed to Mr. A. E. Forstall, 58 William street, and all other matter pertaining to the Association to MR. GEORGE G. RAMSDELL, Secretary, at the above address.

[NOTICE.]

The July Meeting of the Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE OF THE PRESIDENT,
SAN FRANCISCO, CAL., May 24, 1905.

To the Members of the Pacific Coast Gas Association:

Date of Meeting.—Attention is again called to the coming meeting of the Pacific Coast Gas Association, which will be held in this city, July 18th, 19th and 20th next, a little less than two months distant.

Question Box.—Mr. E. C. Jones has kindly consented to edit the Question Box for this year's meeting, and inquiries in connection therewith should be sent to him, his address being 628 Rialto Building, San Francisco. The Question Box is a department of the Association work which is of continually increasing importance, and Mr. Jones' editorship will insure success, especially so if the members will make free and unhesitating use of his valuable services.

New Members.—What have you done towards increasing the life and value of the Association by adding new members? Blanks have been furnished you for this purpose, and if you have not already sent a name or two to the Secretary it is earnestly hoped that you will soon do so, as you must certainly know of some eligible and desirable person whom we would like to welcome as an active member, or firm as an associate member.

Department Editors.—Do not overlook the fact that Mr. G. S. Colquhoun, of Fresno, is the "Wrinkle" Editor; Mr. R. P. Valentine, of Sacramento, is the "Experience" Editor; Mr. G. H. Hollidge, of Oakland, is the "Novelty" Editor; and Mr. Geo. P. Low, of San Francisco, is the Association Historian. All of these departments need your assistance.

Programme.—An excellent programme is being arranged and all members should now begin arrangements to be present.

Very sincerely and fraternally, L. P. LOWE, President.

BRIEFLY TOLD.

DEATH OF MR. WILLIAM T. LEES.—With much regret we report the decease of Mr. William T. Lees, whose death occurred in the Seney Hospital, Brooklyn, N. Y., the evening of the 2d inst. Mr. Lees had been abroad on a 3 months' leave of absence from the Consolidated Gas Company, which had been granted him in the hope that foreign travel would benefit his health. On the return voyage he was taken seriously ill aboard the steamer, and the sad sequel is as told above. In 1880 he was appointed Engineer to the New York Gas Light Company, of

which Company his father (the late Mr. Thomas K. Lees) was then President. It will, of course, be remembered that the manufacturing plant of the New York Company was located at 21st street and Avenue A. After the merger which caused the formation of the present Consolidated Gas Company (Nov., 1884), deceased continued in the position of Engineer of the 21st street station of the Consolidated Company up to the date of his death. He was a graduate of the Class of 1875, School of Mines, Columbia University, and was one of the founders of the Columbia Chapter, Delta Kappa Epsilon. He went to Germany in 1876, where he took a post graduate course in chemistry at the Heidelberg University. While a student at the University he made the acquaintance of the lady who subsequently became his wife, the marriage occurring in 1881. His domestic life was an exceptionally happy one. He loved his home, and his happiest hours were spent with his family and the circle of immediate friends who shared in its hospitality. He was highly respected by the officers of the Consolidated Gas Company, and his sterling qualities brought him rich reward by the esteem in which he was held by those with whom he came in contact. He was born in Brooklyn, N. Y., in 1852, and is survived by his widow, two sons and a daughter. For the main facts in this recital we are indebted to the courtesy of Mr. Charles L. Rowland.

MEMBERS OF THE STATE LIGHTING COMMISSION.—"Governor" Higgins, sparing no time between his signing of the bill for a State Lighting Commission and the filling of the places thereon, has named these citizens to serve, at the rate of $8,000 each per annnum—the appointees were named late last Monday:

Jas. R. Sheffield, of New York city. Qualifications for the place: Formerly served New York city in the Assembly, and also held the place of Fire Commissioner under the Strong occupancy of the Mayor's chair. Warm personal friend of President Roosevelt and "Governor" Higgins. Records do not show that he knows anything about gas manufacture or gas distribution.

B. B. Shedden, of Plattsburg, N. Y. Qualifications for the place: Is a member of the State Board of Regents, was for 12 years Judge for Clinton county, and was for 9 years District Attorney for Clinton county. No means of gauging his friendliness with either Washington, D. C., or Albany, N. Y., authorities. No record in the gas business.

John C. Davies, Camden, Oneida county. Qualifications for the place: Served at the head of the law department of the State for 4 years—2 under ex-Governor Roosevelt and 2 under ex-Governor Odell. Close pseornal friend of President Roosevelt. As with his confreres, no record in the gas business.

NOTES——

THE D. M. Steward Manufacturing Company, of Chattanooga, Tenn., has very wisely established a permanent office and depot in New York, from whence will be delivered shipments direct of its burners and lava tips. The new headquarters are in 47 Murray street, which is right in the center of the business heart of the city.

IN connection with the recent sales' reduction made by the Springfield (Mass.) Gas Light Company the following terse statement was issued: "The work of modernizing the manufacturing plant of the Company, in which $300,000 has been expended, is now nearly completed, and the plant is to day probably the best equipped gas plant of its size in the United States. The stockholders of the Company who subscribed for the last stock issue at $200 per share have during the past year received dividends netting them practically 6 per cent. upon the capital invested. The Company has paid taxes during the same period of $17,000 of which amount $14,000 was paid to the city of Springfield. This amount is nearly 70 per cent. more than the amount of taxes paid by the Company when the present management assumed control."

A CORRESPONDENT in Yonkers, N. Y., forwards the following under date of the 15th inst.: "The Northern Westchester Lighting Company has been organized to take care of the lighting business of the villages of Ossining, Briarcliff and Croton-on-Hudson, N. Y. The new Company has acquired the properties of the several lighting companies now covering this territory. At the head of the new corporation is Mr. F. A. Stratton, the President of the Westchester Lighting Company, but although he is connected with the Westchester Lighting Company, the Northern is in no way connected with the older Company, but is a personal venture of Mr. Stratton, who has for years been a firm and constant believer in the future development and progress of the territory which he now will seek to light."

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—CONTINUED FROM PAGE 884.]

TWENTY-EIGHTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD AT CHICAGO, ILLS., IN THE AUDITORIUM HOTEL, MAY 17, 18 AND 19.

FIRST DAY—MORNING SESSION.

The President introduced Mr. Jacob D. von Maur, of St. Louis, Mo., who read the following paper on

CEMENT JOINTS.

Mr. President and Members, Western Gas Association—During the past year the Laclede Gas Light Company received notice from the Director of Public Works, of the city of St. Louis, to discontinue the use of cement joints in the laying of our gas mains throughout the city, on the ground that these joints would undoubtedly leak in the future, which would necessitate the tearing up of the streets in order to repair the same. As there has never been any objection on the part of the city to the use of lead, it can be assumed that the city officials feel that there is a greater chance of leakage in our gas mains where the joints are made with cement than where they are made with lead. In order to convince the city officials that by using cement for joint making the leakage would be lessened rather than increased, and that there would, therefore, be less tearing up of the streets to repair such leaks, it was decided to make a thorough investigation of the whole subject, and to that end information was requested from a large number of gas companies throughout the United States, in order to determine what the experience was in other cities.

A circular letter was, therefore, written to all the leading gas companies, being careful to select such companies so that the answers when compiled and tabulated would represent the average judgment of gas engineers throughout the country. The letter is quoted below in full:

"The city authorities of St. Louis recently requested the Laclede Gas Light Company to discontinue the use of cement in making up the joints of gas mains, claiming that the use of cement for this purpose is unsafe and will result in an abnormal number of leaks, which would necessitate the tearing up of the city streets for the purpose of repairing the same. We, of course, hold quite the opposite view to that held by the city, but in order to settle the question once for all, and to the satisfaction of all concerned, we should like to get data from such gas companies as are at present using cement in laying gas mains, and to that end we respectfully ask you to answer the following questions:

"1. To what extent are you using cement in the laying of gas mains in your city?

"2. How many years have you been using cement?

"3 Have leaks in gas mains increased or decreased since you started to use cement for the joints instead of lead?

"4. Have any really serious leaks occurred on a cement joint when the work was properly done?

"5. Is there any objection on the part of the city authorities to the use of cement for this purpose?

"6. Do you make any provision for expansion?

"7. In your judgment, assuming that pipes are laid with the minimum cover of 4 feet and joints properly made with cement, do you think the chances for a leak would be increased or decreased over what they would be had the joints been laid with lead?"

"8. What brand of cement do you use?

"Any information which you desire to impart will be appreciated."

That the importance of the question was appreciated by all is best shown by the number of answers received, there being a total of 52 answers out of a total of 60 requests. With a large number of the answers came a request for a copy of the report when the investigation was completed. Our President, Mr. O. O. Thwing, requested the writer to furnish the information to the gas fraternity in the form of a paper, to be read before this Association.

A synopsis of all the answers received is given in detail in the appendix; also a summary of all the answers. A careful survey of the answers as received brings out the following points:

1st. You will note that, in general, those answers which are unfavorable to the use of cement come from cities where cement has never been tried very extensively.

2d. There seems to be a prejudice against the use of cement in the business sections of the very large cities.

3d. In a number of cases the cement joint was used to a very limited extent with very good success, yet for some unexplainable reason its use was not continued.

4th. In every case, with one exception, Portland cement was used, and in the exception noted Rosendale cement was used.

5th. There is a difference of opinion as to whether it is necessary to use the foreign or more expensive brands of Portland or domestic cements.

6th. There is a very wide difference of opinion as to whether provision should be made for expansion or not, but in every case where provision was made at all it was done by inserting lead joints at stated intervals.

7th. It seems to be the generally accepted opinion that cement should not be used in soft places or in any place where there is likely to be a settlement of the pipe, or where the pipe is subjected to vibration.

8th. It is very important to note that in almost every case the tests applied to pipe laid with cement joints are many times greater than the tests applied to pipes laid with lead joints.

9th. In only one case was an objection made by the city officials to the use of cement joints, and this objection was removed as soon as the value of the cement joint was demonstrated; so that at present we have no record of an objection on the part of the city officials to the use of cement in making up joints.

10th. In no case has the leakage increased by the use of cement and in nearly every case the leakage has decreased.

It is now my purpose to discuss each one of the above items, but before doing so I give below full reports of what has been done in St. Louis.

Experience in St. Louis.

I have not been able to determine to what extent cement was used by the old Company in St. Louis. At various points where we excavated we found cement joints. On several lines on which cement was used the joints leaked very badly, notably the 16-inch high pressure line leading from Station "A" to Station "G." That these joints were not made properly was evidenced by the fact that in many cases we found the yarn sticking out of the joint, near the bottom of the bell, and I feel sure that wherever a leak has been found the cause was due to a joint being improperly made.

This Company commenced laying its mains with cement last May and has laid an increasing number of feet, with cement joints, each month since that time, until now all lines are laid with cement. Better than any discussion I could give will be special reports on work actually done. Starting with the size 4-inch—the smallest we lay—I give below in full reports of work done:

First.—A report of test made to determine at what pressure a 4-inch cement joint, properly made, will leak, and to ascertain whether such joints will leak when they are subjected to a settlement of the pipe.

"I beg leave to submit to you the following report on the special test made upon 4 lengths of 4-inch pipe. The joints were 5 in number and the material mixed in the following proportions: Cement, 2 quarts; water, 1½ pints.

"These joints were allowed to set for 36 hours and then a trial pressure of 60 pounds was put on, which was gradually increased until we reached the limit of the engine, viz.: 125 pounds per square inch. This pressure was allowed to remain for 30 minutes, without any apparent variation in the gauge. The joints were also tested with soapsuds every 5 minutes to see if any leaks could be detected.

"In order to see if a cement joint contained any elasticity, a man was placed in the middle of the line, and after the center blocking was removed, danced up and down on it, causing it to fluctuate from 6 inches to 8 inches each way, and even at this very high pressure and undue strain no leaks were found, neither was the cement disturbed in any manner.

"The blocking was then taken away from the ends and the plug and the cap left free of support, in order to see if the high pressure would move them out of place, but no motion was seen.

"The pressure was then reduced to 15 pounds per square inch. In order to ascertain the amount of give or play a cement joint would allow, we subjected the line to the following harsh test or treatment:

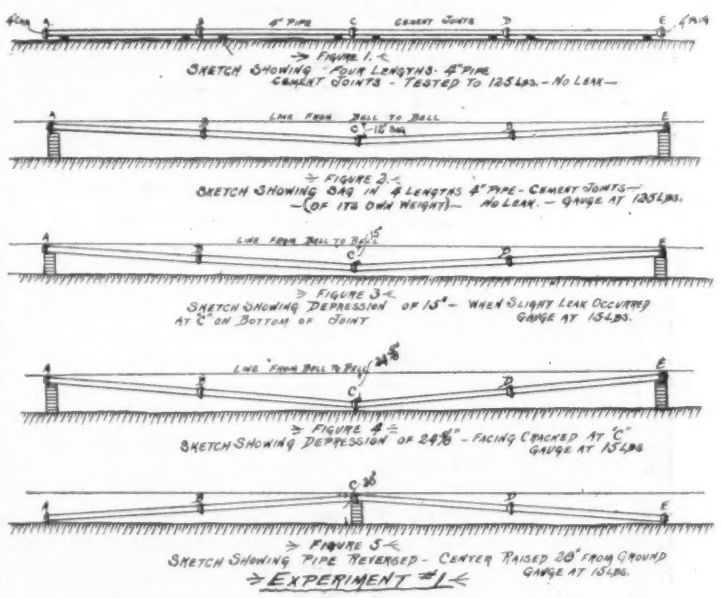
"The two ends were gradually elevated until they were 25 inches above the ground level, then the center blocking was removed and the pipe allowed to sag in the middle. It was found that the sag amounted to 12 inches.

"In order to find the point of fracture in the facing of the joints, the pipe was gradually weighted down until at a sag of 15 inches a slight leak in the bottom was discovered where the cement began to lose amalgamation with the iron. Additional weights were placed upon it until the pipe reached the ground, which sag amounted to 24⅝ inches, as per sketch. The facing then cracked in several places.

"The process was then reversed, the two ends being left free, the block being placed in the middle. It was found that when the curve was reversed the leak in the bottom stopped and for a while the joint was tight again. This reversed process was continued until the center was at a height of 28 inches from the ground. The free ends were then swinging in the air, and, in order to keep them on the ground, weights were placed upon them.

"There was only one joint that was in any visible way disturbed during the whole test, and that was the center one. As a final touch the whole 4 lengths were again blocked up to a height of 24 inches and then pushed off and allowed to drop the entire distance to the ground, and even after this shock no fractures were apparent in the joints. A few photographs of the test were taken and will be furnished to you in a few days."

Sketches Illustrating Experiment No. 1.


4" PIPE
CEMENT JOINTS
FIGURE 1.
SKETCH SHOWING FOUR LENGTHS 4" PIPE, CEMENT JOINTS - TESTED TO 125 LBS. - NO LEAK -
LINE FROM BELL TO BELL
FIGURE 2.
SKETCH SHOWING SAG IN 4 LENGTHS 4" PIPE - CEMENT JOINTS - (OF ITS OWN WEIGHT) - NO LEAK. - GAUGE AT 125 LBS.
FIGURE 3.
SKETCH SHOWING DEPRESSION OF 15" - WHEN SLIGHT LEAK OCCURRED AT C ON BOTTOM OF JOINT
GAUGE AT 15 LBS.
FIGURE 4.
SKETCH SHOWING DEPRESSION OF 24⅝" - FACING CRACKED AT "C"
GAUGE AT 15 LBS
FIGURE 5.
SKETCH SHOWING PIPE REVERSED - CENTER RAISED 28" FROM GROUND
GAUGE AT 15 LBS.
EXPERIMENT #1
NOTE:- JOINT C IS SHOWN DISTORTED.
ACTUALLY, THE FOUR LENGTHS, FORMED ALMOST A PERFECT CURVE.

Second—Lucky Street, 6-Inch Main.

"I beg leave to submit the following report, complying with the letter of the Superintendent of the Street Department in regard to a special test, in order to see if cement joints could withstand a pressure of 50 pounds.

"We took 3 lengths of 6-inch pipe, a plug and a cap, in all 4 joints, and used 'Star' cement in the following proportions:

Joints.	Cement.	Water.
1	2 quarts.	1½ pints.
2	2 "	1½ "
3	2 "	1⅝ "
4	2 "	1⅝ "

One-fourth gill of muriate of ammonia.

Illustrations Showing Experiment No. 1.

Special 4-Inch Test, Cement Joints, Tested to 125 Pounds, Showing Depression of 24⅝ Inches at Central Joint "C," Sept. 22, 1904.

Special 4-Inch Test, Cement Joints, Showing Depressed Joint, Central Joint "C," after Depression of 24⅝ Inches. Sept. 22, 1904.

Testing Engine. Capacity 125 Pounds. Aug. 3, 1904.

Special 6-Inch Test, Cement Joints, Tested to 100 Pounds, Laid in 24-Inch Trench. Aug. 31, 1904.

Test Pump and Gauge—Special 6-Inch Test Gauge at 25 Pounds; August 31, 1904.

"The last solution was made as an experiment to see what the effect of the ammonia salt would be on the joint, and its action upon the cement.

"These 4 joints were thoroughly caulked and rammed, and after being allowed to set for 40 hours were then subjected to a pressure of 24 pounds, and this was gradually increased until the gauge stood at 100 pounds, which pressure was maintained for half an hour.

"The joints were thoroughly inspected and tested while the pressure was being applied, and even at this high figure no perceptible leak was discovered nor was a variation of the gauge visible. The pressure was not increased beyond this figure for fear of an accident happening, due to the enormous pressure."

Third—Old Manchester Road, 6-Inch.

"As you requested, I put 165 feet of 6 inch pipe together for an experimental test. The test was made in the following manner:

A 10-pound pressure was put on, then each joint examined carefully; after that 5 pounds at a time, each time thoroughly tested until we had 50 pounds pressure, which was all the pump would supply, and still no leak.

"Five ounces of yarn were used to a joint, 9 or 10 strands to the first yarn, which was driven back solid. The joint was then filled and a second yarn of 11 or 12 strands put in and driven hard. The joint was then faced with a thin layer of cement.

"The cement used for this test was 'Red Ring,' and was mixed 1½ quarts of cement to 1 pint of water; the cement then set 72 hours before it was tested."

Fourth—Report from Washington University:

"Six-inch pipe with lead joint was tested at Washington University in order to determine at what pressure the lead would give way. The following are the results: At 13,900 pounds pressure the lead moved; at 24,740 pounds pressure the iron broke.

"With a cement joint: At 29,450 pounds the cement cracked on the outside; at 32,000 pounds the iron broke."

"Holes were drilled into the 6-inch pipe to facilitate making the test of the joints, so that the tension at which pipe broke does not represent the total tensile strengh of the iron. The test is given simply to show the relative strength of lead and cement joints."

Fifth—Vandeventer Avenue:

One thousand feet of 10-inch was laid with cement joints and tested to 50 pounds, without showing any leak. The soil was saturated with water.

Sixth—Sarah Street—12 Inch Line Running from Sarah to Easton:

"The following are details of a test which was put on the new high pressure 12-inch line on Sarah street.

"The section of pipe tested consists of 19 lengths of standard 12-inch pipe, joined together with cement. The joints—20 in all—including the end which was plugged—were cement. On Friday, September 16,

1904, and 24 hours after the last joint was made, a test pressure of 10 pounds to the square inch was put on the line with the result that all the cement joints, with the exception of 2, showed no sign of a leak. The 2 which did leak were made by a new man, which probably accounts for their not holding as well as they should have."

Seventh—Osceola Street—16-Inch Pipe:

"A test was made of the joints on the 16 inch main on Osceola street between Broadway and Minnesota, with a pressure of 4½ pounds.

"Ninety-three cement and 18 lead joints were tested. The pressure was on for 1 hour, during which time it lost only 1-tenth of an inch. This was due to leaks in plugs at either end of the line, the joints of which were made of plaster of paris."

Eighth—Lynch Street—20-Inch Pipe:

"Yesterday a test was made on a section of the new 20 inch main on Lynch street. There were 36 lengths of pipe with 16 lead and 21 cement joints. The test lasted 1½ hours and not a joint leaked under a pressure of 12 pounds."

Ninth—24-Inch, High Pressure on Lucky Street:

"I beg leave to submit the following report concerning the cement joint tests made on the 24-inch high pressure line on Lucky street. The brand of cement used is known as 'Star,' and the following operation and proportions were used:

"The bell and spigot of each pipe were thoroughly washed and cleaned of all foreign material and then placed home. A grouted yarn of 6 strands was thoroughly caulked into place, after which was placed cement of the following proportions: Cement, 5 quarts; water, 1½ quarts plus 1 gill. This amount of cement is sufficient to finish the entire joint, which includes filling and facing. After the cement batter is placed in the joint, by hand, a caulking tool of the third size is used and the cement then thoroughly rammed. A second yarn of 7 strands is then put in dry and driven back with the same caulking tool and a hammer. The joint is then faced.

"The whole job, consisting of 15 joints, including the cap and plug, after setting 27 hours, was subjected to a test of 10 pounds of air and the joints all examined and tested with soapsuds. As everything was found to be in perfect condition, the pressure was gradually raised to 25 pounds and maintained at this figure for 1 hour, without any visible sign of a leak or variation in the gauge reading.

"Since this test was made we have found it necessary to use 8 quarts of cement to 2 quarts plus ½ pint water. This additional amount is due to larger joints and hard driving of the cement. On one of our tests a few joints were seen to 'sweat' at 15 pounds. In order to see if 'patching' would be feasible in this case a trial was made, but it was found a flat failure."

Tenth—24-Inch, High Pressure on Lucky Street:

"I beg leave to submit the following report concerning the test on the 24-inch high pressure main on Lucky street. There were in all 56 cement joints, and the cement used was of 3 different grades, viz., 'Star,' 'Red Ring' and 'Dyckerhoff.'

"It was noticed that the last named brand took about ½ pint more water to the customary 8 quarts of cement than we are accustomed to use; otherwise, the standard proportions as already reported were used.

"These joints were allowed to set for 40 hours and then a test of 15 pounds was applied and the line was found to be tight, without a single leak or sweat."

Eleventh—24-Inch, High Pressure on Magazine Street:

"I beg to submit the following report concerning the test on the 24-inch high pressure line on Magazine street and Webster avenue. There were in all 60 cement joints mixed in the following proportions: Cement, 8½ quarts; water, 2 quarts, plus 3½ gills. After these joints had been allowed to set for 36 hours we applied a test of 20 pounds per square inch and found the line tight in every respect. The brand of cement used is known as 'Red Ring.'"

Twelfth:

"On Broadway, 31 lengths of 30-inch pipe were tested to a pressure of 30 pounds, the gauge being allowed to stand 2 hours without showing any drop. The joints were also tested with soap suds and no leaks were found. The cement used was the 'Star' cement.

"A test was made of 88 cement and 20 lead joints on the 16-inch main on Osceola street, between Minnesota and Virginia avenues, with a pressure of 10 pounds. The pressure was left on for 1 hour 40 minutes, during which time each joint was tested with soap and water. At the expiration of the time the gauge still registered the full 10 pounds.

"The following day, after the 16-inch main on Osceola street had been connected to the main which Nicholson is laying on Virginia avenue, a 5-pound pressure was put on both lines. The gauge again remained stationary, not varying in the slightest degree. The pressure was left on for 1 hour."

Thirteenth:

The following is a test on the 24-inch main on King's Highway, south of Chouteau (11 lead joints and 14 cement joints).

No. of Joints. Cement.	No. of Joints. Lead.	Pressure Pounds per Sq. Inch.	Duration of Test.	Length of Time Last Joint was Made Before Test.
14	11	16	3 hours.	40 hours.

Temperature at which Joints Were Made.	Kind of Cement Used.	Foreman in Charge of Work.
16 to 24° F.	"Star" and "Red Ring" in equal parts.	Wm. Farrell.

Note.—Warm water was used in mixing the cement.

Fourteenth:

The following is the test made on the cement joints on 12-inch main on Magnolia street, between Lawrence and Vandeventer:

No. of Joints.	Pressure Pounds per Square Inch.	Duration of Test.	Length of Time Joints were Made before Test.	Kind of Cement Used.	Foreman in Charge of Work.	Temp. at which Cement was Mixed.
88	20 lbs.	1 hr.	65 hrs.	"Star."	S. Williams.	33 to 50°.

Fifteenth:

The following is a test on 12-inch main on the north side of Magnolia between Spring and Grand:

No. of Joints.	Pressure Lbs. per Sq. in.	Duration of Test.	Length of Time Last Jt. was Made Before Test.	Temperature at which Cement was Mixed.	Kind of Cement Used.
64	20	1½ hrs.	40 hrs.	33 to 50°	"Red Ring."

Sixteenth:

"A test of 4-inch cement joints, which had been made when the thermometer registered 31° F., was made to see what effect freezing weather would have upon the cement. Ten lengths of pipe were laid for the test and the joints made with 'Star' cement. In every case the water used in mixing the cement had been slightly warmed. Immediately upon the completion of every joint, it was wrapped with a sack and covered with a layer of dirt about 8 inches deep. After a 40-hour set (from Saturday afternoon until Monday morning) an air pressure of 10 pounds was put on the joints, which were then tested with soapsuds for leaks. The pressure was then raised to 20 pounds and the joints were again tested with soapsuds. In neither case was there a leak found. The pressure was again raised, this time to 30 pounds. When this pressure had been on an hour a final test was made with soapsuds, and again no leaks were found. The results of this test would warrant the statement that cement joints are not affected by moderately cold weather."

It will be noted that these are reports of actual tests made by various foremen and street clerks throughout the city, and the reports are given verbatim. The last 7 tests were made in order to determine whether it was safe to make joints in freezing weather. Under ordinary conditions, if proper care is used, it would appear from these few experiments that it is perfectly safe to make cement joints when the thermometer registers as low as the freezing point. The above tests, together with a number of others, are shown in detail Table No 1.

Now, referring to the 10 items on pp. 922-923, under the head of "Discussions," the answers received which were unfavorable to the use of cement came from cities where cement had never been tried very extensively. Of the reports from 52 cities only 10 used cement entirely and 19 almost entirely, whereas 23 do not use cement. In view of the favorable results obtained in 29 cities, together with the experience in St. Louis, as shown in the various tables and experiments, it does seem that the great saving and advantages to be gained by using cement joints are not fully appreciated. Table No. 4 shows the saving in money, per mile of pipe laid, for each size.

Another great advantage is the fact that a cement joint offers more resistance for the passage of electric current than a lead joint does. Mr. E. E. Brownell, in his "Electrolytic Survey of the City of St. Louis," cites an example of a 6-inch main 100 feet long, which being tested showed a resistance of 12,000 ohms.

In order to get some idea as to the relative resistance of the various kinds of joints, an experiment was made in St. Louis by making up 4 short pieces of 4-inch, cast iron pipe. The first two joints were made with an asbestos gasket in the back of the bell to prevent the spigot from touching the bell. The joints were made with cement in the usual manner. The third joint was an ordinary cement joint without the asbestos gasket, while the fourth joint was made of lead in the usual manner. A report of the test is shown below:

Joint No. 1, of asbestos and cement, shows a resistance of 18.2 ohms; No. 2, of asbestos and cement, shows a resistance of 19.18 ohms;

TABLE No. 1.—*Showing Results of Tests, Cement Joints, Different Sizes of Pipe.—St. Louis, Mo.*

Number of Test	Size of Pipe	Number of Cement Joints in Test	Number of Lead Joints in Test	Pressure Used in Pounds	Equivalent Pressure in Inches of Water	Kind of Cement Used	Amount of Cement in Quarts	Amount of Water Used in Pints	Date of Test 1904	High Pressure or Low Pressure	Remarks
1	4"	5	0	125#	3438.7	STAR	2	1⅓	SEPT. 22	SPECIAL TEST	SPECIAL TEST - 4 LENGTHS - 125# FOR 30 MIN. — NO LEAKS.
2	4"	11	0	20#	554.2	STAR	2	1⅓	DEC. 7	L.P.	TEMP. 31° - WARM WATER USED - NO LEAKS -
3	6"	30	0	4#	110.8	STAR	1¼	⅘	AUG. 25	L.P.	SMALL PIN HOLE LEAKS DROP MERCURY ¼" IN 3½ MIN.
4	6"	4 TOTAL #1	0	100#	2771.0	STAR	2	1½	AUG. 31	SPECIAL	SPECIAL TEST 3 LENGTHS
"	6"	#2	0	100#	2771.0	STAR	2	1½	"	"	6" PIPE - JOINTS MADE DIFFERENTLY - 100# TEST -
"	6"	#3	0	100#	2771.0	STAR	2	1⅚	"	"	FOR 1 HOUR - NO LEAKS -
"	6"	#4	0	100#	2771.0	STAR	2	1⅚	"	"	½ GILL MURIATE OF AMMONIA USED IN 1 JOINT
5	6"	14	0	50#	1385.5	RED RING	1½	1½	SEP. 1	L.P.	NO LEAKS
6	6"	100	0	2½#	69.3	STAR	1½	1¼	SEP. 9	L.P.	TEST 3 HRS. NO LEAKS
7	10"	84	0	5#	138.5	●	2½	1⅔	"	L.P.	● ST. LOUIS PORT. K. HAMMER SOIL SAT. WITH WATER - NO LEAKS
8	12"	101	0	5#	138.5	STAR	3	2¼	NOV.	L.P.	NO LEAKS
9	12"	20	0	10#	277.1	STAR	3	2¼	SEP.	H.P.	2 JOINTS LEAKED
10	12"	100	0	2½#	69.3	STAR	4	2½	SEP. 4	L.P.	TEST FOR 3 HRS. NO LEAKS
11	12"	88	0	20#	554.2	STAR	4	2½	NOV. 29	L.P.	TEMP. 33° TO 30° NO LEAKS
12	12"	64	0	20#	554.2	RED RING	4	3½	DEC. 29	L.P.	NO LEAKS
13	12"	46	0	20#	554.2	RED RING	4	2½	DEC. 15	L.P.	NO LEAKS
14	12"	51	4	20#	554.2	●	4	2½	NOV. 22	L.P.	● RED RING & STAR - EQUAL PARTS NO LEAKS
15	16"	93	18	4½#	124.7	STAR	4	2½	SEP. 24	L.P.	TEST 1 HOUR LEAKS ONLY AT PLUGS IN ENDS
16	16"	32	3	5#	138.5	STAR	4	2½	SEP. 24	L.P.	CEMENT JOINTS HELD TIGHT 1 SLIGHT LEAK IN LEAD JOINT
17	16"	88	20	10#	277.1	STAR	4	2½	SEP.	L.P.	TEST 1 HOUR 20 MINUTES NO LEAKS
18	20"	42	0	5#	138.5	STAR	5	3	SEP. 20	L.P.	NO LEAKS
19	20"	21	16	12#	332.5	STAR	5	3	SEP. 29	L.P.	TEST 1½ HOURS NO LEAKS
20	24"	15	0	25#	692.7	STAR	5	3	AUG. 24	H.P.	TEST 1 HOUR NO LEAKS
21	24"	47	0	23½#	623.5	STAR	8½	5	SEP. 10	H.P.	NO LEAKS
22	24"	56	0	15#	415.6	●	8½	5	SEP. 6	H.P.	● STAR - RED RING - DYCKERHOFF NO LEAKS
23	24"	51	0	12½#	346.4	STAR	8	5	AUG. 27	H.P.	SIX LEAKY JOINTS
24	24"	37	0	15#	415.6	STAR	8	5	SEP.	H.P.	FOUR LEAKY JOINTS
25	24"	60	0	20#	554.2	RED RING	8½	5	SEP. 26	H.P.	NO LEAKS
26	24"	14	11	16#	443.4	●	8	5	DEC. 15	H.P.	● STAR & RED RING - EQUAL PARTS TEMP 46° TO 26° - NO LEAKS
27	24"	37	14	15#	415.6	●	8	5	DEC. 9	H.P.	● STAR & RED RING - EQUAL PARTS NO LEAKS
28	24"	40	0	40#	1108.4	RED RING	10	5½	OCT. 1	H.P.	NO LEAKS
29	24"	62	0	17½#	484.9	STAR	8	5	SEP. 14	H.P.	8 SLIGHT LEAKS
30	24"	22	16	20#	554.2	STAR	8	5¼	SEP. 19	H.P.	NO LEAKS
31	24"	44	4	17#	471.1	●	8	5	NOV. 25	H.P.	● RED RING & STAR - EQUAL PARTS 2 SLIGHT LEAKS ON THREE JOINTS
32	30"	31	0	30#	831.3	STAR	7	4½		L.P.	NO LEAKS - TEST 2 HRS.
33	30"	31	0	10#	277.1	STAR	7	4½		L.P.	NO LEAKS - TEST 2 HRS.
34	30"	25	0	10#	277.1	STAR	7	4½		L.P.	NO LEAKS - TEST 2 HRS.
35	30"	70	0	10#	277.1	STAR	7	4½		L.P.	NO LEAKS - TEST 2 HRS.

Note.—All tests made with air, 16-inch and 30-inch bells. Lead space very small.

No. 3, of cement, shows a resistance of 17.64; No. 4, of lead, shows a resistance of .000385 ohms.

This test certainly shows that a cement joint has a great advantage over a lead joint from a purely electrolytic standpoint. The third advantage is the fact that the work can be done with unskilled labor; and, fourth, a cement joint is less liable to leakage than a lead point. This latter I consider the greatest advantage of all.

TABLE No. 2.—*Showing Cost of Cement and Lead Joints and Saving per Joint in Cement over Lead.*

SIZE OF JOINT	CEMENT JOINTS				LEAD JOINTS				SAVING PER JOINT IN CEMENT OVER LEAD
	CEMENT	YARN	LABOR	TOTAL	LEAD	YARN	LABOR	TOTAL	
4"	.02	.012	.04	.072	.375	.008	.075	.458	.386
6"	.03	.02	.065	.115	.50	.01	.10	.61	.495
8"	.04	.025	.10	.165	.75	.015	.125	.890	.725
10"	.05	.03	.135	.215	.95	.02	.15	1.12	.905
12"	.06	.037	.17	.267	1.15	.03	20	1.38	1.113
16"	.08	.05	.20	.33	1.50	.03	.30	1.83	1.50
20"	.10	.057	.30	.457	1.875	.037	.40	2.355	1.895
24"	.13	.068	.44	.638	3.00	.044	.66	3.704	3.066
30"	.14	.085	.55	.775	3.60	.055	.83	4.485	3.71

Second Item.—There seems to be a prejudice against the use of cement in the business sections of the very large cities. I am unable to account for this prejudice, because my experience with lead joints, both in St. Louis and other cities, has been that the largest number of broken mains has occurred in the business section of the city and were laid with lead joints. Last year we had over 100 broken gas mains, over 75 per cent. of which were in the business section of the city, and in every case the joints were made with lead. We have no records showing any broken mains where the joints were made with cement, although there are a great many miles of such mains in St. Louis, which have been laid for a great many years. Last year we laid 60 miles of pipe with cement joints and 35 miles with lead joints, but at this writing we have had only one slight leak on the entire amount of pipe laid.

Amount of lead used in this table is calculated from standard dimensions of pipe and should be the minimum amount used. Table No. 1 is based on actual amounts used in St. Louis.

This remark applies to Tables No. 2-A and 4-A also.

These quantities are actual, as used in St. Louis, Mo., giving good results.

Proportion of water to cement should be in ratio of about 1 to 4.

Actual quantities will vary according to size of bell.

TABLE No. 2-A.—*Showing Cost of Cement and Lead Joints and Saving per Joint in Cement Over Lead.*

SIZE OF PIPE	CEMENT JOINTS				LEAD JOINTS				SAVING PER JOINT IN CEMENT OVER LEAD
	CEMENT	YARN	LABOR	TOTAL	LEAD	YARN	LABOR	TOTAL	
4"	.02	.012	.04	.072	25	.008	.075	333	.261
6"	.03	.02	.065	.115	30	.01	10	.41	.295
8"	.04	.025	.10	.165	40	.015	.125	.54	.375
10"	.05	.03	.135	.215	.60	.02	.15	.77	.555
12"	.06	.037	.17	.267	.80	.035	20	1.035	.768
16"	.08	.05	.20	.33	1.25	.04	.30	1.59	1.26
20"	.10	.057	.30	.457	1.88	.047	.40	2.327	1.87
24"	.13	.068	.44	.638	2.50	.06	.66	3.22	2.582
30"	.14	.085	.55	.775	3.25	.07	.83	4.15	3.375

TABLE No. 3.—*Of Approximate Quantities for Cement and Lead Joints.*

	CEMENT JOINTS				LEAD JOINTS	
SIZE OF PIPE	CEMENT IN QUARTS	CEMENT IN POUNDS	WATER IN PINTS	YARN IN OUNCES	POUNDS OF LEAD	YARN IN OUNCES
4"	1 TO 1½	2.25 TO 4.10	⅘ TO 1⅓	4	7½	2½
6"	1½ TO 2	4.10 TO 5.50	1¼ TO 1⅜	6	10	3½
8"	2 TO 2½	5.50 TO 6.87	1¼ TO 1½	8	15	5
10"	2½ TO 3	6.87 TO 8.25	1½ TO 2	10	19	7
12"	3 TO 4	8.25 TO 11	2 TO 2½	12	23	9
16"	4 TO 5	11 TO 13¾	2¼ TO 2½	15	30	9
20"	5 TO 6	13.75 TO 16.50	2½ TO 3½	20	37½	10
24"	8 TO 8½	20 TO 23.38	5 TO 5½	27	60	16
30"	7 TO 7½	19.25 TO 20.62	4 TO 4½	27	72	17

Note.—Lead space in 16-inch bells was very small.
Lead space in 24-inch bells was very large.

The writer claims that if a main is properly laid with 4 feet of cover, and so as to have an even bearing, as shown in Fig. 1, and not as shown in Fig. 2, there will be less likelihood of a leak or a break with cement than if lead is used; and it is our intention during the coming season to

use cement joints in the business section of St. Louis as well as in the suburban part of the city.

TABLE NO. 3-A.—*Of Approximate Quantities for Cement and Lead Joints.*

	CEMENT JOINTS				LEAD JOINTS	
SIZE OF PIPE	CEMENT IN QUARTS	CEMENT IN POUNDS	WATER IN PINTS	YARN IN OUNCES	POUNDS OF LEAD	YARN IN OUNCES
4"	1 TO 1½	2.25 TO 4.10	4/5 TO 1⅓	4	5	3¼
6"	1½ TO 2	4.10 TO 5.50	1¼ TO 1⅝	6	6	4¾
8"	2 TO 2½	5.50 TO 6.87	1¼ TO 1½	8	8	5¾
10"	2½ TO 3	6.87 TO 8.25	1½ TO 2	10	12	6½
12"	3 TO 4	8.25 TO 11	2 TO 2½	12	16	10
16"	4 TO 5	11 TO 13.75	2¼ TO 2½	15	25	12
20"	5 TO 6	13.75 TO 16.50	2½ TO 3½	20	37½	14½
24"	8 TO 8½	20 TO 23.38	5 TO 5½	27	50	21½
30"	7 TO 7½	19.25 TO 20.62	4 TO 4½	27	65	21½

TABLE NO. 4.—*Showing Approximate Saving per Mile of Main.*

Size.	Saving per Mile.
4 Inches.	$170.00
6 "	218.00
8 "	319.00
10 "	398.00
12 "	490.00
16 "	660.00
20 "	834.00
24 "	1,249.00
30 "	1,632.00

TABLE NO 4A.—*Showing Approximate Saving per Mile of Main.*

Size.	Saving per Mile.
4 Inches.	$114.80
6 "	129 80
8 "	165.00
10 "	244.20
12 "	337.92
16 "	554.40
20 "	822.80
24 "	1,137.08
30 "	1,485.00

See note under Table No. 2a.

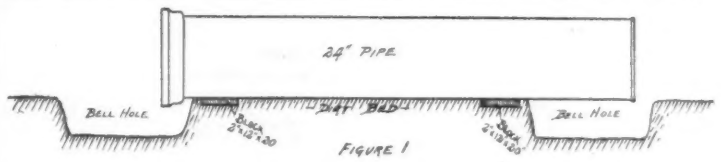


FIGURE 1

CORRECT PIPE BEDDING — BLOCKING COUNTERSUNK.

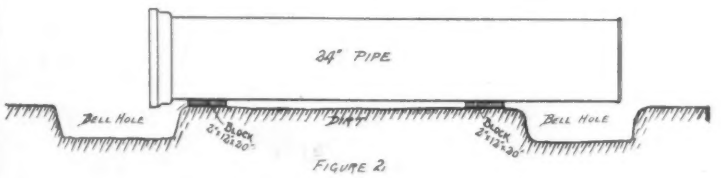


FIGURE 2.

INCORRECT PIPE BEDDING — BLOCKING ON TOP OF DIRT

Fourth and Fifth Items.—Regarding the kind of cement to be used, our experience as well as that of other cities shows it is immaterial what brand is used. Any good American Portland cement will give good results, and as it is cheaper to use the domestic than foreign brands there is no good reason for using the latter. Rosendale cement may give good results, but it is considered good engineering to always use Portland cement below the surface of the ground, and as the difference in cost is trifling, I can see no advantage in using the Rosendale.

I would suggest, however, to those who have never used cement for joint making purposes that they start with Dyckerhoff cement, and as the men become more efficient in their workmanship a cheaper brand of Portland cement can be substituted.

Tables Nos. 5 and 6 show the properties of the various makes of cement. The information was furnished by Mr. W. Purves Taylor, Engineer of Test, Bureau of Surveys, Philadelphia, and Mr. W. H. Henby, Engineer of Tests, Water Department, St. Louis.

Portland cement in barrels weighs 400 pounds gross, 380 pounds net, 4 bags to the barrel; natural cement in barrels weighs 300 pounds gross, 280 pounds net, 3 bags to the barrel; Portland cement only contains 3.6 cubic feet packed and 4 cubic feet loose.

It is best to buy cement in barrels rather than bags, in case the cement is to be stored.

Sixth Item.—Referring to provision for expansion, I agree thoroughly with Mr. Forstall, of Philadelphia, that it is not necessary to provide for expansion. A survey of the answers will show that lead joints are inserted every 4th or 5th joint in some cities and 1 lead joint to the block in others. Surely if 1 lead joint to the block is sufficient, then 1 lead joint in every 5th or 6th joint is more than sufficient. It would be in-

TABLE NO. 5.

DEPARTMENT OF PUBLIC WORKS
TESTING LABORATORY
Average Results of Natural Cement Tests—Made in 1903.

Brand	Number of Samples		Number of Briquettes		Fineness in Per Cent			Specific Gravity	Setting				Per Cent of Water		Ult. Tens. Strength in lbs per sq. in. Neat				Manufacturer
									Time in Min.		Temperature								
	Called	Reject	Made	Broken	No. 50	No. 100	No. 200		Initial	Hard.	Air	*	Neat	Sand	24 Hours	7 Days	28 Days	6 Mos.	
○ Cumberland & Potomac	74	2	604	492	0.6	7.2	17.9	2.814	20	70	74.6-75.2		33.0	11.3	150	239	295	340	Cumber & Pot. Cem. Co.
○ Improved Anchor	94	17	736	648	0.4	6.9	19.7	2.924	76	311	71.2-72.6		25.3	11.4	133	229	338	590	Coplay Cement Co.
○ Improved Bonneville	338	7	2652	2230	0.0	4.3	14.2	2.952	14	61	72.2-72.8		26.5	11.5	172	241	321	442	Bonneville Cem. Co.
Improved Shield	1	0	14	14	0.0	3.2	13.0	2.997	14	44	70.0-70.0		27.0	11.8	117	184	279		Lawrence Cem. Co.
○ Improved Union	111	2	888	686	0.0	4.2	13.6	2.961	11	38	71.4-71.6		25.2	11.4	217	251	325	454	American Cem. Co.
Improved Warner	1	1	14	14	1.0	5.8	13.0	2.781	20	260	82.0-83.0		34.0	13.6	36	100	186		C. Warner Co. Agents
Alpha	70	0	560	476	0.0	7.4	24.6	3.149	37	346	71.4-73.5		19.2	9.3	320	497	739	787	Alpha Port. Cem. Co.
○ Atlas	12	2	152	124	0.0	8.4	23.7	3.100	27	318	68.8-72.3		17.2	8.9	409	661	728	767	Atlas Port. Cem. Co.
Columbia	1	1	14	14	0.0	6.6	21.0	3.049	14	283	71.0-72.0		25.0	10.4	273	414	442	—	American Cem Co.
Dexter	2	0	28	28	0.0	7.8	23.4	3.119	144	267	72.6-75.6		19.0	9.3	335	769	817	—	Dexter Port. Cem. Co.
Dragon	32	0	272	188	0.1	6.4	23.5	3.093	61	336	66.0-67.2		20.5	9.5	331	382	672	764	Lawrence Cem. Co.
○ Giant	443	6	3298	2712	0.0	8.0	24.1	3.141	89	345	72.2-74.2		19.5	9.3	412	741	804	788	American Cem. Co.
Helderberg	1	0	14	14	0.0	2.4	13.6	3.093	164	376	62.0-70.0		21.0	9.4	134	373	642	—	Helderberg Cem. Co.
♀ Hemmoor	23	11	254	224	0.0	6.0	23.6	3.104	43	199	71.6-72.1		22.0	9.6	299	489	537	538	Port. Cem. Fabr. Hemmoor
Krause's	11	0	146	118	0.0	5.6	21.5	3.078	47	263	82.4-83.9		19.7	9.4	435	639	755	654	Martin's Creek Port. Co.
○ Lehigh	732	46	5432	4626	0.0	8.0	24.0	3.144	72	340	72.0-72.2		12.0	9.3	370	680	787	822	Lehigh Port. Cem. Co.
Nazareth	3	0	42	34	0.0	5.7	24.1	3.102	40	347	72.0-72.0		20.0	9.4	284	672	726	—	Nazareth Cem. Co.
Northampton	9	0	126	102	0.0	6.1	25.0	3.094	62	327	67.1-68.7		19.7	9.4	311	732	758	867	Northampton Port. Cem. Co.
Phoenix	7	0	98	82	0.0	3.0	20.9	3.097	52	273	76.0-78.1		21.9	9.8	420	656	690	631	Phoenix Pt. Cem. Co.
♀ Saturn	7	2	98	86	0.0	4.6	22.0	3.076	11	69	72.0-73.2		23.6	10.1	241	423	530	550	W. T. Bradley Co. Agents
○ Saylor's	71	4	586	492	0.0	6.2	24.3	3.139	32	384	71.9-72.8		20.1	9.4	180	607	735	797	Coplay Cem. Co.
○ Star	108	19	5126	4304	0.0	6.9	23.9	3.129	79	319	70.7-72.9		19.5	9.3	422	753	783	704	Bonneville Cem. Co.
Vulcanite	7	0	98	84	0.0	9.3	24.0	3.104	105	351	63.3-71.9		19.0	9.3	292	755	812	765	Vulcanite Port. Cem. Co.
○ Whitehall	85	3	674	548	0.0	7.0	25.8	3.140	64	322	71.0-72.7		19.3	9.3	457	749	787	868	Whitehall Port. Cem. Co.

NOT RECORDED

762

* Rise in temperature of paste during setting.
○ Average of accepted cement.
♀ German.

TABLE NO. 6.

Brand	Per Cent Fineness	Condition of Pats boiling	Setting		Ultimate tensile strength in lbs. per □in.						Remarks
			Initial	Final	Neat		1 to 3 Mississippi river sand				
			Minutes	Minutes	7 Days	28 Days	7 Days	28 Days	3 Mos.	6 Mos.	
	1	2	3	4	5	6	7	8	9	10	11
Hannibal Atlas	92.1	O.K.	76	233	750	841	300	385	432	429	1, 2, 3, 4, 5 and 7 are average of 50 lots 9 " " " 42 " 6 and 8 " " 32 " 10 " " 21 " 11 " " 6 "
Red Ring	90.9	O.K.	96	264	911	933	326	414	429	443	1, 2, 3, 4, 5, 7 and 9 " " 50 " 6 " 8 " " 38 " 10 " " 37 " 11 " " 7 "

teresting to have some of the members explain just why they insert the exact number of joints which they do, as there must be some reason for so doing. Frost in St. Louis last winter reached a depth of 3 feet to 3 feet 6 inches.

Our experience, of course, is all based on 4 feet of cover, and it may be that if the pipes are laid with a less cover it would be necessary to make some provision for expansion. Two years ago we laid some 10 miles of 3-inch wrought iron pipe in cement and pitch and made no provision for expansion. This pipe is under a constant pressure of 250 pounds to the square inch, and yet has never shown any leaks at the joints.

Seventh Item.—It seems the generally accepted opinion that cement should not be laid in soft places, the idea being that the pipe might settle, and on account of the rigidity of a cement joint leaks would develop more readily than with lead joints. In the face of experiment No. 1 it would seem that there is a great deal more elasticity in a pipe line laid with cement joints than has been generally supposed. I should not hesitate to use cement under any conditions where I would be willing to lay a gas pipe. If the ground is so soft as to make it dangerous to use cement joints, I should certainly make provision to get a good foundation before laying the pipe, no matter what kind of joint was used.

Eighth Item.—Regarding the high pressure under which cement joints are usually tested, I believe that this is done more as a precaution than from any real need. According to the nature of cement it is necessary, in order to develop its full strength, for it to set at least 7 days. Since this is impracticable in pipe laying, tests are usually made within 24 hours. I would, therefore, be in favor of applying a test of a few pounds on ordinary low pressure work rather than put on a test of from 30 to 50 pounds, which seems to me a useless expenditure of money after it has once been determined that a cement joint properly made will remain tight. Items 9 and 10 are self explanatory.

A number of tables are attached which, with the detailed information contained in the various experiments, may prove useful to those contemplating the use of cement joints who have heretofore used lead.

CONCLUSION.

It is hoped that the detailed information contained in this paper will be of assistance to those who have not had experience in making joints of cement, but it is well to bear in mind that the essential and all important principle in laying any gas main is that the main must be laid on a solid foundation. Too much has been written regarding joint making—too little regarding the foundation. Without having the foundation it is useless to try and make a tight pipe.

Before closing I wish to take this opportunity to thank all the gentlemen who answered our circular letter, and whose answers as given in the appendix, form the most valuable part of this paper.

The appendix to Mr. von Maur's paper covers 25 pages, the matter thereon being confined to replies from those to whom the eight questions, as appearing *ante*, p. 922, were sent, per circular letter. The summary of the answers thereto is appended as follows:

Question No. I.—"To what extent are you using cement in the laying of gas mains in your city?"

Replies.—Entirely, 10; almost entirely, 19; for repairs to mains only, 2; in works only, 1; do not use cement, 20.

Question No. II.—"For how many years have you been using cement?"

Replies.—One year, 2; three years, 1; five years, 3; six years, 3; seven years, 1; eight years, 2; ten years, 3; fifteen years, 3; twenty years, 2; twenty-five years, 1; thirty years, 1; forty years, 1; forty-seven years, 1; fifty years, 1; fifty-five years, 1; have always used cement, 3; did not answer, 3; do not use cement, 20.

Question No. III.—"Have leaks in gas mains increased or decreased since you started to use cement for the joints instead of lead?"

Replies.—Decreased, 19; experience not long enough to answer, 3; have always used cement, 6; no change, 2; used for repairing on leaks only, 1; do not use cement, 19; never used lead, 1; did not answer, 1.

Question No. IV.—"Have any really serious leaks occurred on a cement joint when the work was properly done?"

Replies.—No, 29; seldom, 1; did not answer, 2; do not use cement, 20.

Question No. V.—"Is there any objection on the part of the city authorities to the use of cement for this purpose?"

Replies.—No, 35; did not answer, 1; do not use cement, 16.

Question No. VI.—"Do you make any provision for expansion?"

Replies.—No, 17; yes, 12; did not answer, 6; do not use cement, 17.

Question No. VII.—"In your judgment, assuming that pipes are laid with the minimum cover of 4 feet and joints properly made with cement, do you think the chances for a leak would be increased or decreased over what they would be had the joints been laid with lead?"

Replies.—Decreased, 29; did not answer, 5; do not use cement, 18.

Question No. VIII.—"What brand of cement do you use?"

Replies.—Dyckerhoff, Portland, 6; Bonneville, Portland, 1; Manheimer, Portland, 2; any kind of Portland, 8; Atlas, 2; Alpha, 1; Alsen, 3; Orchard brand Roman, 2; Star, 1; Hoffman brand, Rosendale, 1; American hydraulic, 1; did not answer, 9; do not use cement, 15.

(To be Continued.)

[Prepared for the JOURNAL.]

Samples of Coal as Shown by Retail Coal Dealers.

By "G. D. R."

When one is traveling in the United States, or in fact any other country, he is always sure of seeing various methods of management, different schemes for advertising and systems of business in considerable number. In this article I will refer to some of the methods of sample distribution and exhibition as noticed by me. The selling of coal by sample is, of course, different from the operation of selling fabrics by sample. Oils, varnishes, drugs and the like may be disposed of by sample quite readily because of the easy method of transportation of the little specimen, carpet samples are also easily distributed, attached to a price card or by similar method; so may samples of flour and kindred products be sent through the mails or by express package, and oftentimes quite an elaborate business is built up on the sample plan; but samples of coal are not so readily handled. However, the various plans of sample exhibition and distribution that I noticed are exhibited in the attached cuts. Sometimes the exhibition consists in the placing of a sample of the coal on a tablet of neatly finished hardwood, stained and polished, as in Fig. 1. This tablet is placed in a conspicuous position on the sample stand in the office or salesroom and is properly labelled. Often a series of samples are thus arranged and tagged with price, grade, etc. The custom is to cement the sample to the wood tablet. I saw a set of 12 of these samples in one office. Each tablet was made of black walnut and finely finished, presenting an at-

tractive appearance. Then in another office I observed that, instead of the tablet form, they used a number of stands made according to the design shown in Fig. 2. Each stand was about 8 inches high. A cherry stain was put on the wood in this case and the sample of coal was cemented to the center top. This sort of a stand permits the customer to pick it up for close examination. These stands were also properly tagged. In other offices and salesrooms of coal dealers I noticed that samples of coal were selected in convenient lump forms. The lumps were suspended to a hook-board by means of a cord, something after the fashion illustrated in Fig. 3. The base or hook-board consists of a backing made of boards, about 3 feet square. This is edged to make it strong, and painted a dull red. Then a series of hooks are inserted. Above each hook is pasted a description, price, etc., of the sample of coal to be hung to the hook by means of the loop formed by the cord. Thus the samples can be hung up and removed for inspection very easily. One of the systems of sample exhibition I noticed in a flourishing coal yard consists in the making up of frames for each sample, as exhibited in Fig. 4. These little frames are made of hard wood. They are of convenient proportions to accommodate a good sized sample of coal bedded within the frame. The frame is properly backed. The cementing composition is put on liberally and the specimen is attached to the backing of wood very securely.

The heavy card system of sample distribution is not much of a success unless the cards with their samples are for light handling only. Fig.

Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

Fig 6

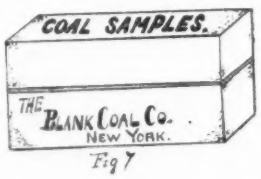


Fig 7

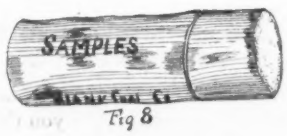


Fig 8

Fig 9

Fig 10

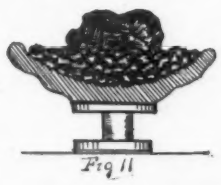


Fig 11

5 is a drawing of the card method. If you want to express some of these cards with the coal sample attached you have to pack the thing in excelsior. The card is heavy stock. One end is used for the printed description, the other is daubed with cement for fixing the sample thereon. As long as the affair is placed on exhibition on the desk or like place it answers all purposes as a sample card. Transportation through the mails usually breaks off the sample, even though the card is packed. Fig. 6 is a foreign system of sending samples through the mails. A common tube of heavy card stock is used.

Sometimes wood or sheet metal tubes are employed for this purpose. The tube is filled with excelsior and in the center is packed the coal sample, as shown in the sectional sketching in the cut. When the tube is closed the address can be pasted on and the package mailed. Some of the coal companies have neat little cases of wood or tin for containing a number of samples of coal, as illustrated in Fig. 7.

These little packages are partitioned off and the different samples arranged in the respective compartments. Fig. 8 illustrates a common bamboo tube, sample case. The bamboo is selected of convenient diameter, and it is made so as to open and close by shaping the edges of the opening down. The natural partition walls of the interior of the bamboo form the ends. It may seem odd to some to learn that sometimes dealers adopt the picture frame order of coal sample display. I did not see many cases of this kind. In one office, however, they had a number of frames supported to the wall of the room with cards, precisely on the picture hanging order. Instead of a picture in the frame I saw a sample of coal. It seems that the dealer bought 12 picture frames and used the backs as a base for the coal samples. He obtained a cement and applied this to the backs and then sprinkled on sand. When the sand had dried he added sufficient cement in the center to fix on the coal sample. Thus he got a sample coal frame as in the cut, with a sand ground. Samples of coal bedded in clay for sample showing purposes were also seen and a drawing of one of these combinations is presented in Fig. 10. This consists simply in using colored clays as the bottom of the coal specimen. The specimen is sunken into the clay and when the latter dries and hardens a sample fixture results that can be used to advantage under certain conditions.

Sometimes the double or triple sample system of display is used in the coal office. Fig. 11 illustrates this plan. It involves the employment of utensil shaped devices of the order shown in the cut, in sectional sketching. Then in the base of the vessel is placed a scattering of one kind of coal, while on top of this base surface is placed a lump or two of another grade. Two assortments of descriptive cards are necessary for this device. In some of the modern equipped offices I noticed high grade, up-to-date, plate-front show cases neatly arranged for display.

Notes on the Use of Rare Earths in Electric Illuminants.

By MURRAY CHARLES BEEBE, in *Jour. Am. Chem. Soc.*

As scientists and engineers have come to a realization of the inefficiency of existing methods of illumination, the problem of improving upon these inefficient methods has received considerable attention. While the element carbon has heretofore been almost exclusively used commercially in both arc and incandescent lamps, the rare earth oxides, so-called, have recently been found to possess desirable properties for use as illuminants.

We are already familiar with the work of Auer von Welsbach in producing gas mantles of thoria and ceria. To use the rare earths in electric illuminants was a logical step. However, the problem presented difficulties not encountered in the production of a serviceable gas mantle. We should remember that an illuminant, to be an improvement over the Edison or carbon filament lamp in the matter of efficiency, must be capable of withstanding a higher temperature than the carbon filament for a length of time sufficient to make it commercially attractive. One might at first suppose that it would be difficult to improve upon the carbon filament in the matter of efficiency, or the ability of the filament to operate commercially at a very high temperature, since carbon is practically infusible and the rare earths are fusible and in a carbon arc. Carbon, however, slowly vaporizes at the temperature at which it operates in the incandescent lamp and, finally, after 400 to 600 hours has depreciated in light giving power to such an extent that it is best to replace it. It is the vaporizing properties rather than the melting points of the materials with which we are concerned in this problem. It has long been known that substances which are commonly regarded as insulators, such as glass and porcelain, become quite good conductors of electricity at higher temperatures.

Prof. Buff, in 1854, read a paper "On the Conductivity of Heated Glass for Electricity," and Faraday's "Researches" give a number of examples of such conductors. Jablochkoff attempted to use refractory materials, such as lime, to separate and insulate the carbon electrodes of his Jablochkoff candle. He soon found that these supposed insulators in reality became conductors and emitted light by virtue of the current passing through them from one electrode to another. He even designed terminals with which to carry the current of electricity to the lime conductor, with the idea of making a lamp based on this principle. It is safe to say that had it been possible to produce electricity as cheaply then as now, lamps of the Nernst type would have been known commercially much sooner than they were, for Jablochkoff's persistent attempts at commercial exploitation were baffled largely by the undeveloped state of electrical engineering.

That the rare earth oxides are exceedingly refractory and do not readily vaporize at a high temperature, makes the Welsbach mantle possible; that these oxides will conduct electricity when hot, makes the Nernst lamp possible. Of all the oxides which conduct electricity but few are refractory enough for an efficient filament of glower. It was in determining the most desirable of these and in fixing the best proportions to use that Nernst did his greatest work.

Ordinary red iron oxide, when formed into filaments and baked, will conduct electricity at ordinary temperatures, but such filaments do not withstand sufficiently high temperatures to be used as light sources.

Magnesia and thoria, on the other hand, withstand exceedingly high temperatures, but these conduct electricity only with great difficulty. In general, mixtures of two or more oxides conduct better than a single oxide and, in turn, the fusing point of the mixture is lower than that of either oxide alone. It seems that the vaporizing point is not necessarily lowered, judging from the fact that thoria and the small amount of ceria used in a Welsbach mantle form quite a stable mixture, or possibly a chemical combination, while ceria alone or uncombined is a somewhat undesirable oxide from its rather marked tendency to vaporize.

It would be a long story to take up the various properties of all the rare earth oxides and the possible combinations with one or more of the others. A mixture which is used largely in lamps of the Nernst type, is composed of 85 per cent. zirconium oxide to 15 per cent. of yttria earths. Zirconium is not properly classified among the rare earths, though it is customary to do so. The term "yttria," as used here, means in reality a mixture of many oxides occurring together in certain minerals and closely allied in physical and chemical properties. Zirconia was used in comparatively large quantities for the first Welsbach mantles and, hence, considerable attention had been given to various methods of producing it for such use. While many of the experimental glowers were made from zirconia bought from chemical supply houses, it was impossible to obtain uniform results from such material. Good zircon ore, which is a zirconium silicate, occurs in abundance in Henderson county, N. C., and this ore contains about 67 per cent. of zirconium as oxide. By treating this ore in the following manner quite uniform results are possible: The ore is ground very fine in a ball mill and mixed with twice its weight of crude acid potassium fluoride. This is placed in an ordinary graphite crucible and heated slowly until thoroughly fused, and the ore is completely dissolved. The fused mass is then ground and dissolved in hot water containing a quantity of crude hydrofluoric acid equal to about one-tenth the weight of the fused mass. The silica remains undissolved as potassium silico-fluoride (K_2SiFl_6) and the potassium zirconium fluoride (K_2ZrFl_6) is drained off while boiling hot into a silver-lined vessel. Upon cooling, the filtrate develops crystals of potassium zirconium fluoride and, doubtless, small quantities of other elements in similar crystal form. Iron and many other impurities which are present in the ore, or have been introduced by the use of the crude reagents, remain in the liquor which is drained from the crystals. The crystallizing process may be much hastened by artificial cooling. Rinsing the crystals with cold water is likewise beneficial in removing all traces of the mother liquor. The crystals are gathered and fused in a platinum dish. By this means any silica present seems to be vaporized and other impurities, like titanium, are made insoluble. The fused mass is ground and dissolved in hot water and crystallized as before. A few of the first crystals are removed, or, instead, alcohol may be added to the solution until a small amount of crystalline precipitate is formed. These first crystals contain much of the undesirable impurities. They are, therefore, removed and the crystallizing process is continued. The pure crystals are then dissolved in hot water and the solution is made rather acid by the addition of pure hydrofluoric acid. Ammonia is now carefully added to the hot solution until a small amount of precipitate is formed. If the solution of the crystals has been made acid, the addition of ammonia, even until alkaline, will precipitate iron and some other foreign metals, but will leave the zirconia in solution until it is cooled and diluted.

This method was found to be an exceedingly simple one for removing iron from the zirconia, which by other methods is a troublesome operation. The hot filtrate, after removing the precipitate of iron, is dropped directly into a cold ammonia solution which at once precipitates zirconia as a hydroxide. Up to this stage of the process it has been necessary to use vessels and utensils affected by hydrofluoric acid. The last precipitation may be made in glass or wooden receptacles. The precipitate is washed several times by decantation, and then pressed out on suction filters and after a thorough drying by heat is powdered and sifted through fine bolting cloth and is then ignited in a platinum dish with a very gradually increasing temperature and with constant stirring. The ignition process requires several hours, or sometimes days, the final temperature being a good red heat. Traces of silica are removed by this operation.

The physical condition of the precipitate is dependent to a great extent upon the amount of hydrofluoric acid in excess. When precipitated from an almost neutral solution the precipitate dries into hard pieces translucent in appearance and which are difficult to pulverize. With the greater excess of acid the material dries in lumps resembling starch, in which condition it is much more suited to our purpose.

The zirconium made by this process seems to be reasonably pure. Precautions must be taken to keep out dirt and to that end it has been found advantageous to purify the air admitted to the rooms where the glower materials are prepared by passing it through a water spray. An absolutely pure zirconia is not required, and though a trace of silica improves the efficiency and seems to diminish the initial depreciation of candle power of a glower, it is a dangerous element to have present, for slightly more than a trace will cause a rapid change in potential difference at the glower terminals, besides causing lack of uniformity in the behavior of glowers of one batch, due to the fact that the silica becomes unevenly distributed among the glowers by vaporization and condensation occurring in a roasting process, which will be described later.

Although the purest materials make the best glowers for direct current, it cannot be said that an absolutely pure zirconia is desirable for alternating current glowers. Silica is particularly undesirable in direct current glowers. In general, a glower which operates well on direct current, showing almost no change in potential difference, will show a greater change when operated upon an alternating current circuit.

The purity of the zirconia may be controlled to some extent by the number of times the material is crystallized during the purifying process, though each operation is attended with some loss of material. Physical properties are quite as important as chemical properties, and the procedure above described was evolved to give proper physical as well as chemical properties to the material.

After all—"Handsome is that handsome does"—and the real test for the glower material lies in its ability to make good glowers. Test glowers have been made from hundreds of lots of zirconia, and these, together with careful chemical records of each lot, have been the guide in developing the chemical process necessary for the production of good glowers. For direct current glowers a crystallizing process is also considerably used, but from a solution of zirconia in hot dilute hydrochloric acid. After two or three such crystallizations it is necessary to precipitate from a hydrofluoric acid solution, as in the first process, to get the material into proper physical shape.

As to the yttria used, this is principally obtained from the minerals gadolinite or yttrialite. Gadolinite is found in Norway and Sweden, and also in Llano county, Tex. The Texas deposit seems to be confined in a very small district and there is every evidence that it is a result of volcanic eruption. It is found in crystalline form associated with yttrialite, cyrtolite, fergusonite, rowlandite, allanite and other minerals. The ores from the Llano county district are radioactive and the presence of a pocket in the quartz is generally indicated by bluish discolorations radiating from the pocket through some distance of the surrounding quartz. It is also claimed that the ores contain small quantities of confined helium gas. Gadolinite contains, roughly, 42 to 45 per cent. of yttria earths, 23 per cent. of silica, 13 per cent. iron as oxide, and 9 to 12 per cent. of beryllia. Yttrialite contains 43 to 47 per cent. yttria earths, 30 per cent. silica, 5 to 6 per cent. ceria, didymia and lanthan, as well as small percentages of urania. Fergusonite contains 32 to 42 per cent. yttria earths and 32 to 46 per cent. columbic oxide. Rowlandite contains 47 to 62 per cent. yttria earths, 26 per cent. silica and small percentages of iron and magnesia. Allanite contains 20 per cent. ceria and dydymia, with a small percentage of yttria earths and considerable percentages of iron, calcium and aluminum.

It is a comparatively simple matter to obtain and purify the yttria earths from gadolinite and yttrialite so that they are suitable for glower making. About 1,000 grams of ground ore are dissolved in crude aqua regia. The residue is filtered off and the solution evaporated to dryness, repeating this operation several times, or untill all silica is removed. The neutral solution is then diluted to several liters and the addition of a hot solution of oxalic acid to the hot solution containing the earths brings down the rare earths as oxalates, leaving iron and other impurities in solution. The oxalate is washed thoroughly with hot water and ignited, and the crude yttria earths are dissolved in dilute hydrochloric acid, just sufficient in amount to dissolve the oxide. To the rather dilute and neutral solution, which is cold, crystals of potassium sulphate are added in excess. After standing 24 hours the cerium group has been quite thoroughly separated as double sulphates and the filtrate is then treated with ammonia to bring down the hydroxides of the rare earths, thus freeing them of the great excess of potassium sulphate. The washed precipitate is dissolved in a quantity of pure hydrochloric acid, just sufficient to dissolve it, and again treated with boiling oxalic acid solution, as before. This brings down the rare earth oxalates in sufficiently pure form. The oxalates are thoroughly washed with hot water and ignited, and any remaining potassium is separated from the ignited oxides by washing upon a filter with hot water.

With the yttria, as well as the zirconia, physical properties are im-

portant, and the oxalate method gives an exceedingly fine precipitate which requires no mechanical treatment.

Experiments indicate that the yttria earths of the greatest atomic weights give the most satisfactory results in glowers. In other words, ytterbia is better than yttria. Owing, however, to the great difficulty of separating the yttria earths from each other, which is so far possible only by laborious fractionation processes, entailing great losses, not much has been done toward using the higher atomic weight yttria earths beyond selecting ores which are rich in these earths.

The Llano county ores seem to be superior to the foreign ores in this respect, the atomic weights being yttrialite 115, rowlandite 107, fergusonite 103, and gadolinite 100, while the foreign ores may be as low as 90 or 92.

The zirconia and yttria earths mixed in the proportions given above, namely, about 85 and 15, or 90 and 10, and about 5 per cent. of starch or gum tragacanth, are thoroughly mixed and kneaded into a hard dough and squirted by pressure through a die of proper size. This string, as it may be called, is dried and then broken into suitable lengths which are roasted to an intense white heat in a platinum box. The pieces are then ready to have terminals placed upon them.

A Nernst terminal is made by winding stranded platinum wire about the end of the stick of material and then pasting over with a paste composed of ground glowers and zirconium chloride, thus forming a hard cement.

The Hanks terminal has the platinum imbedded in the glower material, the operation being carried on by the aid of an electric arc in which the glower material is fused.

It appears certain that the mode of conducting the current is partly electrolytic in character. The specific resistance varies with the relative proportions of the constituents. In order to obtain glowers of the same specific resistance when using yttria earths of high atomic weights as when low atomic weight earths are used, it is necessary to have the presence of the higher atomic weight materials in proportion to the atomic weights.

Upon direct current circuits the positive end of the glower generally runs much hotter than the negative end, and a black discoloration appears at the negative end, especially if impurities are present. In fact, this is one of the most certain indications of the presence of an impurity.

A glower operated in vacuum soon destroys the vacuum, probably due to oxygen gas liberated by electrolytic action. That all the current is carried by electrolytic means seems incredible, for the current carried per square unit of cross section is far greater than can easily be accounted for by our usual conceptions of electrolytic laws.

For example, upon direct current and calculated by electrochemical equivalents the entire glower would be decomposed into the constituent elements in a very few minutes. Doubtless electrolytic decomposition and recombination do take place, but is it possible to account for the entire transport of current in this way? The assumption that the current is all so carried seems unnecessary in view of what is known of the power of highly incandescent bodies to ionize air to render it conducting. The air in the neighborhood of a glower is conducting, and to such an extent that the leakage currents from glower to heater had to be reckoned with early in the experimental work, and the difficulty was obviated by the use of a double pole cutout which disconnected the heaters completely from electrical connection with the remainder of the lamp after the glower started.

[To be Concluded.]

The Besemfelder Process for the Direct Gasification of Coal.

The *Journal of Gas Lighting* reports that in the course of an article recently published in the *Journal für Gasbeleuchtung*, Dr. Keppeler has called attention once again to the difficulties in the way of a successful gasification of raw coal in the water gas generator, and has described, as a considerable advance in the economy of water gas manufacture, a process worked out by L. Payens, of Nymwegen; but he has not mentioned a scheme elaborated with the same object in view by Dr. E. R. Besemfelder, of Charlottenburg.

The objections to using raw coal as the fuel in a generator depend upon the formation of tar, upon the bad heat-conducting power of coal, upon the endothermic nature of the reactions of carbonization, and upon the lengthiness of that operation (which is brought about by the two last-mentioned causes) in comparison with a gasification process. The desire to employ coal in the manner indicated is, of course, based on a wish to save the fuel otherwise consumed in converting it into coke, and to retain as perfectly as possible the energy that leaves the water gas generator in the shape of sensible heat. As the Besemfelder process goes further in the direction of economy than that elaborated by Payens—for it aims at the recovery of the heat which is usually wasted when the gasmakers' coke is quenched between its exit from the retort and its entry into the generator—the author (Besemfelder) takes the present opportunity to point out the features that distinguish it.

The Besemfelder process is carried out by feeding small coal into a special kind of flat retort, which is connected with a battery of water gas generators in such fashion that: (1) The coke resulting from the carbonization passes directly into one of the generators without loss of heat; (2) the retort is partially heated on its outside by a combustion of the generator gas after suitable admixture with air; and (3) is partially heated inside by the passage of the hot water gas over and among the fuel it contains. The size of the carbonizing vessel is so calculated in relationship to that of the generators that coal may be fed to it in an uninterrupted supply; it is so long that the coal is completely carbonized by the time it reaches the generating plant; and it is of such area that, when crushed to the size of nuts, the coal forms a layer on the bottom of the vessel only about 20 centimeters deep. A hydraulic main is provided in the retort close to the charging spot; so that the tar is withdrawn very rapidly from all sources of heat. Hence it is assumed as free from naphthaline and uncombined carbon, and, according to Börnstein's exp riments, to contain numerous bodies of the aliphatic series which render it a more valuable raw material to organic chemists than the more purely aromatic tar of the ordinary gas works.

The intimate contact between the small coal passing through the carbonizer and the hot water gas travelling in the opposite direction encourages the rapid liberation of gas, neutralizing the retarding effect generally produced by the low heat conducting power of the coal. Baffles on the bottom of the vessel assist in maintaining this contact, while the current of gas prevents the formation of gaseous cushions round the coal which ordinarily hinder the transfer of heat. Moreover, any water vapor or carbon dioxide in the water gas is decomposed by the hot coal through which it passes; being almost entirely reduced to hydrogen or carbon monoxide. It may be said that the carbonizing vessel acts as a regenerative chamber in which the coal takes the part of the usual checkuer work. The specific heat of the coal, too, rises as its temperature increases; so that, per unit of weight, it is able to take up more heat than the air which is usually run through a regenerating chamber.

By burning the generator gas with the necessary quantity of air round the carbonizing vessel, the sensible heat it contains and the latent heat due to the carbon monoxide in it are recovered. Keppeler regards it as an admirable feature in the Payens process that the sensible heat in the water gas and that in the generator gas should be utilized separately for raising the steam required. In the Besemfelder process, the sensible heat in each gas is also used separately, though for a common purpose. The economy of the latter is greater than that of the Payens process, inasmuch as the heat which is needed to drive the volatile matter out of the coal is not only obtained from the escaping gases of the generator, but may be said to be largely returned to the "coal" [? coke] "so that a notable proportion of that heat remains available for raising steam."

Success in the Besemfelder process is not so dependent, as is generally the case, upon the valves being altered at the correct moment. All that is necessary is that the generators shall be uniformly charged with fairly carbonized coal at a constant temperature, and therefore it is quite possible, while working upon a particular kind of coal, to make the valves change automatically, in a more accurate manner than can be achieved by the most willing hand labor. The process has another advantage over the Dellwik system, in that at any moment there are always the same number of generators being run and being blown; so that the demand for steam and for air is always the same, and the boilers and blowing engines are able to work more efficiently. In fact, a blowing engine large enough in the usual way to supply one water gas generator of a given capacity will be found sufficient for all the (same sized) generators of the plant, because the blast does not have to be shut off at intervals. As regards the economy arising from the insertion of coke in a state of incandescence in the generator, it has been shown by E. Blass, of Essen, and the present author, that the amount of heat wasted when coke is quenched and afterwards raised to the temperature of the water gas apparatus is appreciably greater than the quantity of heat needed to carbonize an equivalent weight of coal.

Of all processes, the Dellwik yields the largest volume of pure water

gas, and turns it out of the generator at the highest temperature. The Besemfelder method of working is therefore best applied to that process. Nevertheless, there is no necessary connection between the two. The larger the quantity of generator gas that can be burnt outside the carbonizing chamber, the smaller is the quantity of water gas that must be passed through the interior—*i. e.*, the smaller is the quantity of coke that must be gasified; and hence it becomes possible to make a mixed gas which only contains an amount of water gas that has been sufficient to expel and fix the gases of distillation. The amount of heat required to carbonize 1 kilogramme of coal is 400 calories at most, even allowing for all the losses of the actual process as operated on the large scale. But, as the author has already demonstrated, 2,020 calories of sensible heat are carried away from the Dellwik generator for every kilogramme of coke gasified, or 0.2 kilo. of coke should suffice to carbonize 1 kilo. of coal. If, then, a market can be found for the excess of coke, the present process is a means of making an illuminating gas very similar in composition to coal gas. In the well-known process called "auto-carburation," cold water gas is introduced into coal gas retorts, and cools them; in the Besemfelder process, the water gas is hot, and heats the retorts. The consumption of fuel for the external firing of the retorts should therefore be larger when the "auto-carburation" plan is followed; and, in the author's opinion, further practical experience only is needed to prove this.

Without throwing aside any coke, it is possible to make about 11,500 feet of coal gas and about 54,000 feet of water gas from 1 long ton of coal by the author's process; the product having so nearly the properties of blue water gas that it can be employed for almost every purpose in place of the latter. The suggested method of working recovers all the heat stored up in the original coal in the most economical manner possible, and also brings about a most favorable conversion of the nitrogen into ammonia; so say the inventors.

Electricity and Fire Insurance.

By Mr. A. H. Mayes, in *Elec. Eng.*

The unfair and inconsistent attitude adopted by many fire insurance companies with regard to premises wherein electric power for lighting and motive purposes is used, is of such wide importance that a little plain speaking will be entirely justified. In the first place, it appears that the powers that guide the helm of the insurance companies have by some mental process, which it is beyond the power of a practical and impartial person to understand, arrived at the conclusion that a supply of electricity on a premises is a source of considerable fire risk, greater, in fact, than had gas or some other agent been employed. Now, looking at the matter honestly and with a perfectly unbiased mind, one is compelled to say at once that such a contention is absolutely unjustified, opposed to common sense, and totally unsupported by the result of experience.

Even allowing that every fire attributed to electrical causes is rightly classified, it cannot be denied that electricity still stands forth as by far a safer agent than gas. It is quite certain that a little more attention to detail in carrying out installations would still further reduce the possibility of fires from electrical causes, and the writer proposes to say a few words upon this from a practical standpoint. How often one sees the cause of fire vaguely attributed to "the fusing of an electric wire." Now, either the fire was not caused in this manner at all or else the wire in question must have been installed under conditions sufficiently extraordinary to take one's breath away. The smallest conductor ever used, or which is supposed to be used for installation purposes, is No. 18 S.W.G., and as the fusing current of No. 18 S.W.G. copper wire is 108 amperes, one is led to ask what sort of branch fuse was in circuit with that unfortunate wire. The alternative conclusion is that there was no fuse at all, and, further than that, one is confronted by the appalling question of how such an enormous current could have found its path, even then, through the wire in question. If due to earthing of the wire, the earth must, indeed, have been of an efficient character, and if due to a "short circuit" the point of contact must have had a strangely low ohmic resistance. Even then we are not out of our troubles, for we have yet to explain how the service company's fuses managed to stand against this great extra demand upon their energies. It will, of course, be evident that the danger point would be reached with a current less than that required to absolutely fuse the wire, but after making all allowances the point requires a large amount of explanation.

Another and more probable source of danger is in installing incandescent lamps in such a manner that the heated bulbs can come into contact with articles of an inflammable character. It is a common practice when installing lamps for lighting a draper's window to attach the lamp to a considerable length of duplex flexible conductor, in order that the light may be hung in any desired position, and thus it is that one sees goods of a highly inflammable character in actual contact with the bulbs. Such a practice as this should be absolutely prohibited, and a rule should be strictly enforced that all lamps used under such conditions be enclosed in a wire net guard or other effective safeguard. The overheating of resistances used in connection with arc lamps is undoubtedly a source of danger, but at the same time one which might be rendered practically nil by proper precautions in the matter of carrying capacity[1] and fixing.

Coming to the question of electricity as used for power work, we are at once confronted by an element of danger in the form of resistances as used for starting and speed regulating purposes. Here again, however, proper precautions would reduce the fire risk to practically nil, but, unfortunately, great carelessness is often displayed in the method of fixing and protecting these pieces of apparatus. A short time since the writer was inspecting a large motor installation in London, and found gross carelessness displayed in the above matter. A 25-horse power starting resistance of the wire coil type had been arranged to stand upon the cement floor in the basement, and as the sheet iron case containing the coils was open at the bottom, a quantity of waste paper and rubbish had gradually worked its way underneath, and actually found its resting place amongst the coils. The above apparatus should certainly have been fixed about a foot from the ground, and have been provided with a perforated iron bottom.

In several other instances it was found that starting resistances were quite unequal to the demands made upon them, having insufficient carrying capacity, and often attaining a red heat in operation. More care was, therefore, essential in selecting a starting resistance suitable for the particular work to be performed. It may be added that the switch and resistance should always be inclosed in an outer case of strong sheet steel which is an adjunct of a very necessary character on account of the fact that a considerable amount of sparking takes place upon the switch contacts, and particles of molten metal are at times thrown off. Main switches should most certainly be inclosed in cast iron cases, as they are frequently liable to rough handling, and it often happens that an arc is set up owing to defective action.

Another important adjunct to power installations is the fuse, and unless a proper type be employed they are undoubtedly a source of fire risk. Whether the open or inclosed type of fuse be selected, there are two points of the greatest importance to be observed—the terminals should be an ample distance apart and the device shall be inclosed in a cast iron case.

If proper attention were paid to the above simple points the fire risk would be still further reduced, and would bring still nearer the day when fire insurance companies will be compelled to admit that electricity is by far the safest agent to employ for both lighting and power.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

The Flick-Liddon interests of Bethlehem, Pa., have secured the right to supply gas in the township of Salisbury, Pa., by virtue of a charter issued over the seal of Governor Pennypacker, the 2d inst. The Flick contingent seem wideawake to the possibilities concerned in the gas supply of the Bethlehem district.

It is rumored that ex-Mayor Seth Low may be appointed to a place on the New York State Lighting Commission. The rumor is too good to be well founded, we fear. The Albanians (meaning Odell-Higgins & Co.) do not wish to be encumbered by men of Mr. Lowe's capacity. We hope we are wrong. [We are right.]

At the annual meeting of the Consumers' Light and Power Company, of Middletown, N. Y., the Directors chosen were: Edmund Millen, E. R. Brown, Floyd W. Morgans and E. E. Conkling. Mr. Morgans succeeds Mr. William Snyder, and Mr. Conkling succeeds Mr. W. A. Marshall, resigned. This is an electric concern.

Mr. J. H. White has resigned the position of Superintendent to the Alton (Ills.) Gas and Electric Company, in order to assume the place of General Manager of the Winona (Minn.) Railway and Light Company. He assumes his new duties the 1st prox.

Contracts for the construction of an artificial gas plant at Fort Wayne, Ind., have been awarded to the Western Gas Construction Company, of Fort Wayne, and to the Kerr-Murray Manufacturing Company of the same city. We have not been advised as to the division of the contracts.

The proprietors of the Peoples Power Company, of Moline, Ills., have announced a cut in the selling rates, amounting to 10 per cent. all round, the new schedule to become effective the 1st prox. If we mistake not, this means that the net rate of $1.12½ cents per 1,000 will rule in Moline on and after the date named.

Here's a yarn that is respectfully referred for consideration to Governor Higgins and to his staff, legislative and otherwise, respecting

1. Surely.

materials for gas manufacture: "Difficulty has been experienced in obtaining illuminating gas from the coal obtainable in the Philippine Islands, and after experiment the government laboratories have found that a much better quality of gas is obtainable from the oil of cocoanuts. Cocoanut oil is a commercial product and therefore readily obtainable, and gas from this source may be made far more cheaply than with the use of coal. The oil is slowly fed into red hot retorts and volatilizes rapidly, there being but a small residue of tar. So successful have been the experiments that there is already an agitation on foot to introduce the idea into the United States in sections where coal cannot be readily had. It is asserted that because of its greater productiveness in gas, bulk for bulk, it would be possible to make use of the oil on the Pacific Coast."

A CORRESPONDENT in Denver, Col., writing under date of the 1st inst., incloses the following: "More than 50 members of the Employees' Association of the engineering department of the Denver Gas and Electric Company, attended the final smoker of the season held by the organization at the St. James hotel, last evening. Following the menu, there was a programme of instrumental music by an orchestra and selections by a colored quartette. Various guests enlivened the meeting with funny stories, and a most enjoyable few hours were spent. The committee in charge comprised M. E. Malone, T. S. Richardson and W. G. Laird."

THE F. W. Gillett Company, for the manufacture of gas and electric lighting fixtures, with headquarters in Pittsburgh, Pa., has been incorporated by L. K Gillett, F. W. Gillett and Charles T. Cornell. It is capitalized in $10,000.

MR. W. A. D'ALEMBERT, of Mobile, Ala., has secured a franchise for the supplying of gas to the residents of Pass Christian, Miss. He proposes to install the acetylene system.

A CORRESPONDENT in Newark, N. J., writing under date of the 3d inst., says: "I read your recent squib to the effect that the Methodist capitalists who control the fortunes of the Ocean Grove (N. J.) Camp Meeting Association will not allow a gas service to be carried out there this season. No doubt you knew whereof you spoke, but for my part I know that quite a number more than a majority of the Grove's cottage owners petitioned the Association early this spring that a gas service be given them."

THE plans and specifications for the new works at the West End station of the Cincinnati Gas and Electric Company, which were prepared by Mr. Fred. Bredel, of Milwaukee, Wis., are completed, so Mr. L. C. Hamlink informs us. Heretofore we have reported the awarding of several contracts in connection with the Cincinnati Company's West End plant.

THE proprietors of the Peoples Gas and Electric Light Company recently issued notice to the residents of Stoneham, Mass., that, until further instructions, the selling rate will be $2 per 1,000 cubic feet, less 10 per cent. for payment within 15 days.

WRITE to the Economical Gas Apparatus Construction Company, of Toronto, Can., for samples of the advertising matter which it has caused to be prepared in furthering the spread of the use of the gas stove.

A CORRESPONDENT in Los Angeles, Cal., writing under date of the 24th inst., incloses the following: "Through Messrs. H. W. O'Melveny and Percey R. Wilson, Los Angeles attorneys, William G. Gallagher, a New York capitalist, has brought suit against the Lowe Gas Company in the United States Circuit Court for the foreclosure of a mortgage, insuring bonds in the sum of $60,000. In the complaint it is stated the Company alleged to have issued the bonds—the Los Angeles Suburban Gas Company—is believed to be insolvent. 'I shall apply for a receiver in about two weeks,' said Mr. O'Melveny yesterday afternoon, 'Mr. Gallagher bought some of these bonds and has never been able to collect anything on them.. It is alleged in the complaint that in December, 1901, 600 5 per cent. 20-year bonds, aggregating $300,000, were issued by the Los Angeles Suburban Gas Company, with the California Bank as trustee. It is also alleged that as security a mortgage upon various property holdings in the city and certain gas pipe lines was given. The complainant asks that an account be taken of bonds issued, of existing obligations of the Los Angeles Suburban Gas Company, and of the amount of unpaid interest due on all bonds. An injunction also is asked for, restraining the Los Angeles Suburban Gas Company, from disposing of any of the property mentioned in the mortgage."

THE proprietors of the Birmingham (Ala.) Railway, Light and Power Company have decided to construct a storage holder up to retaining 750,000 cubic feet.

HERE is a statement of some of the things that are being done by the Los Angeles (Cal.) Gas and Electric Light Company. It was chartered (the gas end) in 1867, and later on, in fact very much later on, it went into the electric current supply trade. To-day the Company has gas plant generative capacity up to an output of 8,000,000 cubic feet per day, and its electric plant can rely upon the constant of 5,000-horsepower. It has 295 miles of gas mains and 1,000 miles of electric city carriers. It supplies 42,000 consumers, makes free connections, furnishes gas regulators on demand, and requires no deposits from intending consumers. In 1889 the price of gas was $2.50 per 1,000 cubic feet; it is now charging 90 cents per 1,000. The current rate is the outcome of 11 voluntary reductions thereon since 1889. Its office building is a credit to the very business heart of one of the handsomest cities in the world, and not one of the employees (they number certainly not less than 550) is dissatisfied with his lot. Its bills are paid on demand. All of which from our point of view appears to the credit of those who have managed it so steadily and well.

MR. GEORGE CARSON, of Iowa City, Ia., will assume control of the properties of the Washington (Ia.) Illuminating Company the 15th inst. Mr. Carson secured control thereof something less than a fortnight ago. His possession means the right to supply gas and electric currents in the named place.

THE only "Burrows," and a right good one he is, says that the resident's of Gray's Harbor, Wash., will have gas by September 1st.

WRITE to the editor of *Gas News*, which is published "Once in a while" by the Gas Department of the Public Service Corporation, of New Jersey, for a copy of Vol. I., No. VII. The inquiry may be addressed to either Jersey City or Newark.

WE understand that Messrs. Flanigen and Dunn, of Wilkes-Barre, Pa., are now in complete control of the properties of the Ottawa (Ills) Gas Light and Coke Company.

THE proprietors of the Waynesboro (Pa.) Gas Company have issued the following rate schedule, which became effective June 1st:

Monthly Consumption. Cubic Feet.	Rate per 1,000.
1,000 and under	$1.50
1,000 to 2,000	1.45
2,000 to 3,000	1.40
3,000 to 4,000	1.35
4,000 to 5,000	1.30
5,000 and over	1.25

THE new net rate established by the proprietors of the Springfield (Mass.) Gas Light Company is 95 cents per 1,000.

THE following is the text of the official action recently taken by the proprietors of the Malden and Melrose (Mass.) Gas Lignt Company respecting the sales rate: "*Voted*, That on all gas bills rendered after July 15th, 1905, the price of gas be fixed at $1.30 per 1,000 feet, and that a discount of 20 cents be allowed on all bills paid within 15 days of the date of the bill, making the net price $1.10 per 1,000 feet if paid within said 15 days."

THE "purists" who wouldn't let the people that made the gas supply of Philadelphia a reality rather than a sham have an extension of their leasehold, seem to have a particularly painful problem confronting them; that is if the following, from the dear, old *Ledger*, of Philadelphia, dated the 6th inst., may be relied upon: "Based upon the records of Controller Walton's office, as filed in the Department of Commerce and Labor at Washington, it is estimated that the city will have to pay the United Gas Improvement Company approximately $20,000,000 if the gas works are taken over in 1907. The records show that the expenditures for alterations, renewals, improvements and betterments were as follows:

1897 (from date of agreement, Nov. 12)	$31,333.12
1898	3,112,829.07
1899	2,473,048.28
1900	1,171,624.06
1901	613,896.45
1902	969,534.17
1903	1,235,844.35
1904	1,000,825.42
Total	$10,608,934 92

"It is estimated by comparison with these figures that the U. G. I. will average $3,000,000 during the next 3 years, up to 1907. This added to the $10,608,943.92 makes a total of $13,608,934.92 expended in 10 years, the period of the lease. To this amount might be added the appraised value of the 25th Ward plant. These works were appraised in 1898 at $1,060,000. At 6 per cent. simple interest the total reimbursement on account of these works would be $1,696,000. Together with all interest calculations to date and internal calculations to the end of the first 10 years of the lease, amounting to a sum estimated at $5,316,000, the recapitulation would appear to be as follows:

Actual expenditures	$13,608,634.92
Interest at 6 per cent	4,680,000.00
Twenty-fifth Ward works	1,060,000.00
Interest at 6 per cent	636,000.00
Total	$19,984,934.92

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

MONDAY, JUNE 12, 1905.

The Market for Gas Securities.

The market for gas securities was about as listless as could be during the week, with prices on the down side as a rule. Consolidated was quoted to-day (Friday) at 185½ to 187, which represents a net loss of 1½ points. The bills have all been signed by Governor Higgins respecting gas and electric lighting supply in this section, as far as he could control such, and the names of the members of the State Lighting Commission will be found elsewhere in this issue. The three are well versed in politics, and their fame in respect of actual gas and electric lighting supply is nil. However, we must wait; there wouldn't be much use in praying.

Brooklyn Union is unchanged, and the same may be said of Peoples, of Chicago, likewise Baltimore Consolidated. There is a steady application in values of the shares, overlying and underlying, of the Public Service Corporation of New Jersey. In respect of the latter it might be remarked that the failure of H. Marquand & Co. did not do the "P. S." much harm, for through it they secured an undoubted bargain in the properties of the Bergen County Company.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 12.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$78,177,000	100	185¼	187
Central Union, Bonds, 5's.	3,000,000	1,000	108¼	110
Equitable Bonds, 6's	1,000,000	1,000	..	109
" 1st Con. 5's	2,300,000	1,000	118	120
Mutual	3,500,000	100	300	320
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	112	113¼
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	..
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	..	..
Northern Union, Bonds, 5's.	1,250,000	1,000	104	106
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106¼	108½
Standard	5,000,000	100	125	130
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	183	122
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	¼	⅜
" ncome Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	6	7
" " Bonds, 5's	5,250,000	1,000	66	66¾
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	107¼	107⅞
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	97½	99
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,026,500	100	107½	109
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	28	
Mortgage, 6's	3,500,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	89½	92
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,506	50	..	50
" Prior Lien 5's	5,603,000	1,000	..	98
Detroit Gas Co., 5's	351,000	1,000	75	80
" Inc. 5's	15,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	104½	105½
" Bonds, 5's	10,500,000	..	107	108
Indianapolis	2,000,000	..	70	75
" Bonds, 6's	2,650,000	..	106½	108
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	..
Preferred	2,500,000	100	95	105
Bonds	10,000,000	1,000	108¼	109
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	100¼	100¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	94	96
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	308¾	311¼
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	200	..

Advertisers' Index.

GAS ENGINEERS.

A. E. Boardman, New York City ... 943
Baxter & Young, Detroit, Mich ... 951
B. E. Chollar, St. Louis, Mo ... 949
David Leavitt Hough, New York City ... 948
Davis & Farnum Mfg. Co., Waltham, Mass ... 952
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 948
Frank D. Moses, Trenton, N. J ... 943
Fred. Bredel Co., Milwaukee, Wis ... 950
Frederic Egner, Washington, D. C ... 956
Geo. R. Rowland, New York City ... 944
Humphreys & Glasgow, New York City ... 953
Isbell-Porter Co., Newark, N J ... 954
J. Alex. Mayers, New York City ... 955
J. F. W. Jost, Philadelphia, Pa ... 948
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 952
The Gas Machinery Co., Cleveland, O ... 940
The Jeffrey Manufacturing Co., Columbus, O ... 950
The Western Gas Construction Co., Fort Wayne, Ind ... 960
United Gas Improvement Co., Philadelphia, Pa ... 947

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City ... 948
Bartlett, Hayward & Co., Baltimore, Md ... 953
Baxter & Young, Detroit, Mich ... 951
Connelly Iron Sponge and Governor Co., New York City 949
Continental Iron Works, Brooklyn, N. Y ... 954
Cruse-Kemper Co., Philadelphia, Pa ... 949
Davis and Farnum Mfg. Co., Waltham, Mass ... 952
Delly & Fowler, Philadelphia, Pa ... 960
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 948
Empire Gas Construction & Improvement Co., N. Y. City 942
Frank D. Moses, Trenton, N. J ... 943
Fred. Bredel Co., Milwaukee, Wis ... 950
G. Shepard Page's Sons, New York City ... 951
Humphreys & Glasgow, New York City ... 953
Isbell-Porter Company, New York City ... 954
J. Alex. Mayers, New York City ... 955
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 952
Lloyd Construction Co., Detroit, Mich ... 942
Logan Iron Works, Brooklyn, N. Y ... 956
Quintard Iron Works, New York City ... 953
R. D. Wood & Co., Philadelphia, Pa ... 954
Riter-Conley Mfg. Co., Pittsburgh, Pa ... 955
Stacey Mfg. Co., Cincinnati, O ... 955
The Gas Machinery Co., Cleveland, O ... 940
The Jeffrey Manufacturing Co., Columbus, O ... 950
The Western Gas Construction Co., Fort Wayne, Ind ... 960
United Gas Improvement Co., Philadelphia, Pa ... 947

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md ... 953
B. E. Chollar, St. Louis, Mo ... 949
Economical Gas Apparatus Construct'n Co, Toronto, Ont 948
Fred. Bredel Co., Milwaukee, Wis ... 950
Humphreys & Glasgow, New York City ... 953
The Gas Machinery Co., Cleveland, O ... 940
The Western Gas Construction Co., Fort Wayne, Ind ... 960
United Gas Improvement Co., Philadelphia, Pa ... 947

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y ... 954
Davis & Farnum Mfg. Co., Waltham, Mass ... 952
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 948
Fred. Bredel Co., Milwaukee, Wis ... 950
Isbell-Porter Co., Newark, N. J ... 954
Kerr Murray Mfg. Co , Fort Wayne, Ind ... 952
Logan Iron Works, Brooklyn, N. Y ... 956
R. D. Wood & Co., Philadelphia, Pa ... 954
Riter-Conley Mfg. Co., Pittsburgh, Pa ... 955
Stacey Mfg. Co., Cincinnati, O ... 955
The Gas Machinery Co., Cleveland, O ... 940
The Western Gas Construction Co., Fort Wayne, Ind ... 960

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 948
R. D. Wood & Co., Philadelphia, Pa ... 954

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 948
Fred. Bredel Co., Milwaukee, Wis ... 950
Isbell-Porter Co., Newark, N. J ... 954
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 952
Stacey Mfg. Co., Cincinnati, O ... 955
The Gas Machinery Co., Cleveland, O ... 940
The Western Gas Construction Co., Fort Wayne, Ind ... 960

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis ... 950
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 952
Michigan Ammonia Works, Detroit, Mich ... 935
The Gas Machinery Co., Cleveland, O ... 940
The Western Gas Construction Co., Fort Wayne, Ind ... 960

GAS METERS.

American Meter Co., New York and Philadelphia ... 959
Detroit Meter Company, Detroit, Mich ... 959
D. McDonald & Co., Albany, N. Y ... 957
Helme & McIlhenny, Philadelphia, Pa ... 959
John J. Griffin & Co., Philadelphia, Pa ... 920
Keystone Meter Co., Royersford, Pa ... 958
Maryland Meter and Mfg. Co., Baltimore, Md ... 958
Metric Metal Co., Erie, Pa ... 939
Nathaniel Tufts Meter Co., Boston, Mass ... 958
Pittsburgh Meter Co., Pittsburgh, Pa ... 957

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia ... 959
D. McDonald & Co., Albany, N. Y ... 957
Helme & McIlhenny, Philadelphia, Pa ... 959
John J. Griffin & Co., Philadelphia, Pa ... 920
Keystone Meter Co., Royersford, Pa ... 958
Nathaniel Tufts Meter Co., Boston, Mass ... 958
Pittsburgh Meter Co., Pittsburgh, Pa ... 957

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn ... 962

GAS AND WATER PIPES.

Charles Millar & Son Co., Utica, N. Y..... 944
Davis & Farnum Mfg. Co., Waltham, Mass..... 952
Donaldson Iron Co., Emaus, Pa..... 944
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 948
R. D. Wood & Co., Philadelphia, Pa..... 954
Warren Foundry and Machine Co., New York City..... 944

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Berwind-White Coal Mining Co., New York and Phila. 950
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SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 911

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N.Y. City..... 944

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 955

GAS TAPPING MACHINES.

George Light, Dayton, O..... 944
H. Mueller Manufacturing Company, Decatur, Ills.. 942 944

CANNEL COALS.

Perkins & Co., New York City..... 950

STOKING MACHINERY.

G. A. Bronder, New York City..... 949

CONVEYORS.

Adam Weber Sons, New York City..... 948
C. W. Hunt Company, New York City..... 950
Dodge Coal Storage Co., New York City..... 935
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 948
Fred. Bredel Co., Milwaukee, Wis..... 950
G. A. Bronder, New York City..... 949
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 952
The Brown Hoisting Machinery Co., Cleveland, O..... 951
The Gas Machinery Co., Cleveland, O..... 949
The Jeffrey Manufacturing Co., Columbus, O..... 950
The Link-Belt Engineering Co., Philadelphia, Pa... 941
The Link-Belt Machinery Co., Chicago, Ills..... 936
The Western Gas Construction Co., Fort Wayne, Ind.. 960

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 952
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 952
Stacey Mfg. Co., Cincinnati, O..... 955

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Standard Oil Co., New York City..... 951
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Fred. Bredel Co., Milwaukee, Wis..... 950
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Connelly Iron Sponge and Governor Co., New York City 949
Fred. Bredel Co., Milwaukee, Wis..... 950
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C. L. Gerould, Bloomington, Ind..... 948

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Adam Weber Sons, New York City..... 948
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James Gardner, Jr., Co., Pittsburgh, Pa..... 948
J. H. Gautier & Co., Jersey City, N. J..... 948
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 940
Missouri Firebrick Co., St. Louis, Mo..... 948
National Pyrogranit Co., New York City..... 948
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 93

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Adam Weber Sons (Graham, Morton [England] System) 948
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(*Concluded from page 935.*)

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y. 954
Davis & Farnum Mfg. Co., Waltham, Mass..... 952
Fred. Bredel Co., Milwaukee, Wis..... 950
Isbell-Porter Co., Newark, N. J..... 954
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 952
Logan Iron Works, Brooklyn, N.Y..... 956
R. D. Wood & Co., Philadelphia, Pa..... 954
Stacey Mfg. Co., Cincinnati, O..... 955
The Gas Machinery Co., Cleveland, O..... 940
The Western Gas Construction Co., Fort Wayne, Ind... 960

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 948

INCANDESCENT GAS LAMPS.

Central Lighting Co., New York City..... 939
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 897
General Gas Light Co., Kalamazoo, Mich..... 939
Geo. G. Ramsdell, New York City..... 337
Welsbach Company, Gloucester, N. J..... 956

BURNERS.

Central Lighting Co., New York City 939
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 897
Wm. M. Crane Co., New York City..... 941

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 897

STREET LAMPS.

Thos. T. W. Miner, New York City..... 944
Welsbach Street Lighting Co., New York and Phila.... 946

PURIFIERS.

Connelly Iron Sponge and Governor Co., New York City. 949
Davis & Farnum Mfg. Co., Waltham, Mass..... 952
Fred. Bredel Co., Milwaukee, Wis..... 950
Isbell-Porter Co., Newark, N. J..... 954
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 952
R. D. Wood & Co., Philadelphia, Pa..... 954
Stacey Mfg. Co., Cincinnati, O..... 955
The Western Gas Construction Co., Fort Wayne, Ind... 960

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 949

VALVES.

Continental Iron Works, Brooklyn, N. Y..... 954
Davis & Farnum Mfg. Co., Waltham, Mass..... 952
Economical Gas Apparatus Construct'n Co., Toronto, Ont 948
Isbell Porter Co., Newark, N. J..... 954
Kerr Murray Mfg. Co., Fort Wayne, Ind 952
Ludlow Valve Manufacturing Co., Troy, N.Y..... 941
R. D. Wood & Co., Philadelphia, Pa..... 954
Stacey Mfg Co., Cincinnati, O..... 955
The P. H. & F. M. Roots Co., Connersville, Ind..... 943
The Western Gas Construction Co., Fort Wayne, Ind.... 960

PUMPS.

De Laval Steam Turbine Co., Trenton, N. J..... 936

EXHAUSTERS.

Connelly Iron Sponge and Governor Co., New York City 949
Davis & Farnum Mfg. Co., Waltham, Mass..... 952
Isbell-Porter Company, Newark, N. J..... 954
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 952
The P. H. & F. M. Roots Co., Connersville, Ind..... 943

PURIFIER SCREENS.

John Cabot, Hoboken, N. J..... 940

GAS STOVES.

American Meter Co., New York and Philadelphia..... 959
Detroit Stove Works, Detroit and Chicago..... 958
Keystone Meter Co., Royersford, Pa..... 958
Maryland Meter & Manufacturing Co., Baltimore, Md. 958
Nathaniel Tufts Meter Co., Boston, Mass..... 958

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 944

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y..... 944

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 953
Continental Iron Works, Brooklyn, N.Y..... 954
Cruse-Kemper Co., Philadelphia, Pa. 949
Davis & Farnum Mfg Co., Waltham, Mass..... 952
Deily & Fowler, Philadelphia, Pa..... 956
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 948
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 952
Logan Iron Works, Brooklyn, N.Y..... 956
R. D. Wood & Co., Philadelphia, Pa..... 954
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 945
Stacey Mfg. Co., Cincinnati, O..... 955

STORAGE TANKS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 952
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 952
Stacey Mfg. Co., Cincinnati, O..... 955

PAINTS.

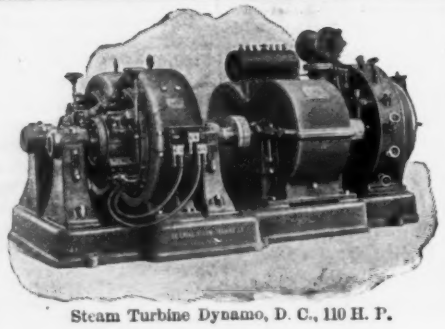
American Standard Composition Co., New York City... 939

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 940

STEAM TURBINES.

De Laval Steam Turbine Co., Trenton, N. J..... 936



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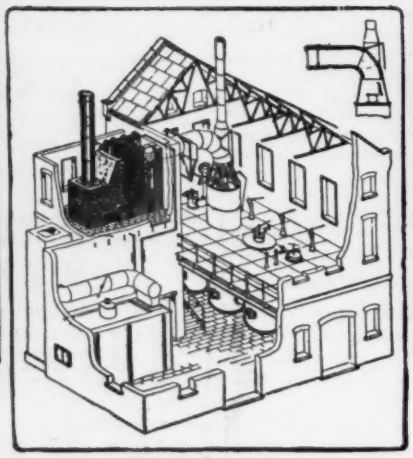

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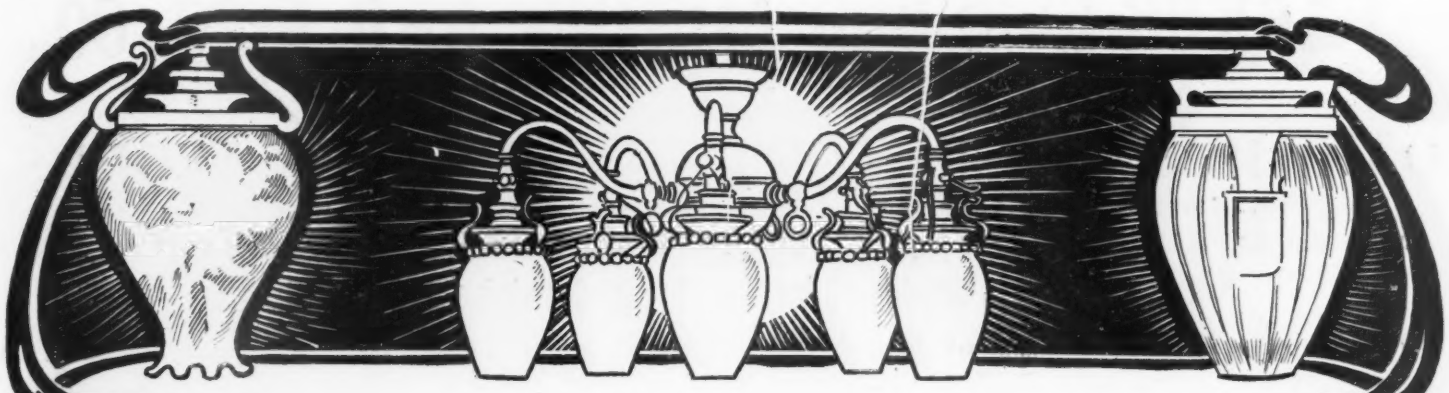

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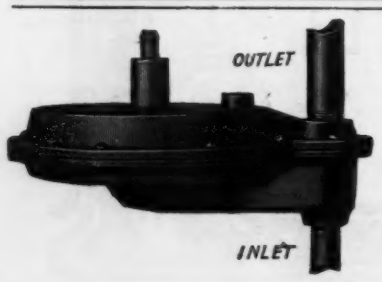

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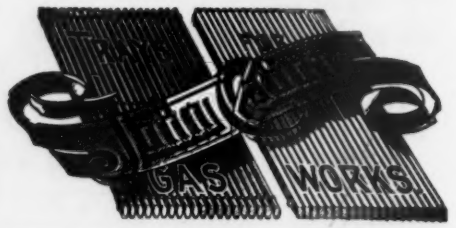

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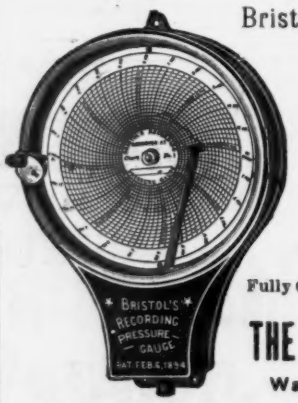

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But all you save on the first cost wil be lost a hundred times over in the increased number of complaints and dissatisfied consumers.

DON'T PUT GOOD GAS IN THE HOLDER AND SPOIL IT AT THE BURNER.

BRAY BURNERS

Have been used by the largest Gas Companies for over forty years, because

THE PROGRESSIVE GAS MAN ONLY WANTS THE BEST.

W. M. CRANE COMPANY,
NEW YORK,

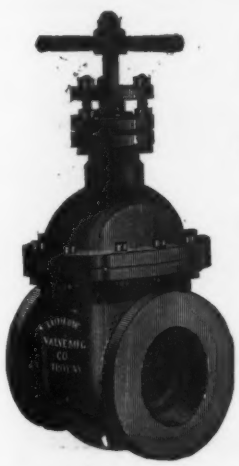
Have you a Bray Blue Book? SOLE AGENTS FOR THE UNITED STATES.

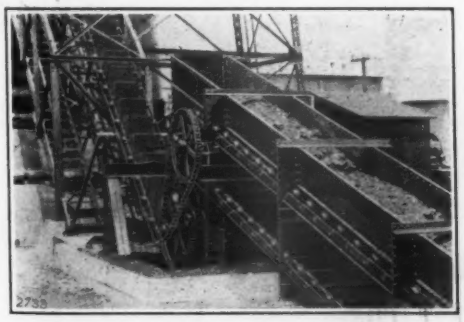
THE
Ludlow Valve Mfg. Co.,
TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",
—FOR—
Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.





COAL-CRUSHING, ELEVATING AND CONVEYING MACHINERY

Erected, 1903, for the Empire Coke Co., Geneva, N. Y.

The machinery consists of steel track hopper, 35-foot centers overlapping pan apron feeder, three-roll coal crusher and 112-foot centers continuous bucket inclined elevator. The machinery handles run-of-mine bituminous coal at rate of 45 tons per hour.

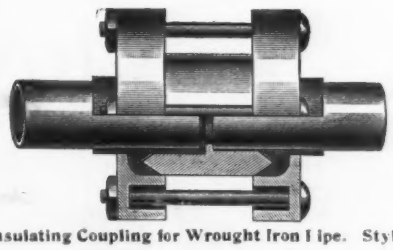
Write for Link-Belt circulars on coal-handling.

LINK-BELT ENGINEERING CO.,
Philadelphia.
NEW YORK: 49 Dey St. PITTSBURGH: Park Bldg.
CHICAGO: Link-Belt Machinery Co.

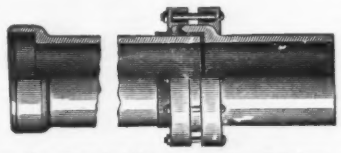
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

Patentee and Manufacturer of Specialties for Oil and Gas Lines.

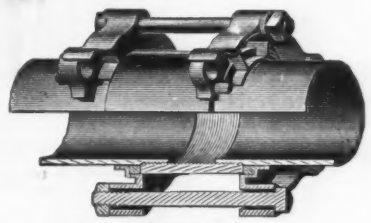


Insulating Coupling for Wrought Iron Pipe. Style 5.

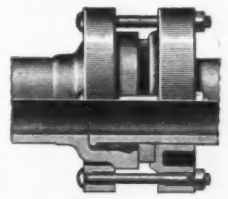


Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.

Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

EMPIRE GAS IMPROVEMENT AND CONSTRUCTION CO.

This Company has purchased the patents and goodwill in the business hitherto carried on and owned by *A. M. Sutherland.* It is now ready to contract for the erection and installation of

ENTIRE GAS WORKS,

or any separate portion of the same, such as **Gasholders, Coal Gas Benches, Lowe-Sutherland** double-superheater **Water Gas Sets,** Scrubbers, Condensers, Exhausters, Purifying Boxes, Street Governors, Street Mains and Main Laying.

The high character of the work done by A. M. Sutherland during the past 15 years will be strictly adhered to and all work is warranted.

Mr. Sutherland remains with the Company for two years President and Director, and will give personal attention to contracts.

EMPIRE GAS IMPROVEMENT AND CONSTRUCTION CO., 49 Wall St., New York.

See it Grow!

Lloyd's Rubber Lute

From January 1st, 1905, to date,
Has been contracted for on Purifiers aggregating

15,324,000

Cubic Feet Daily Capacity.

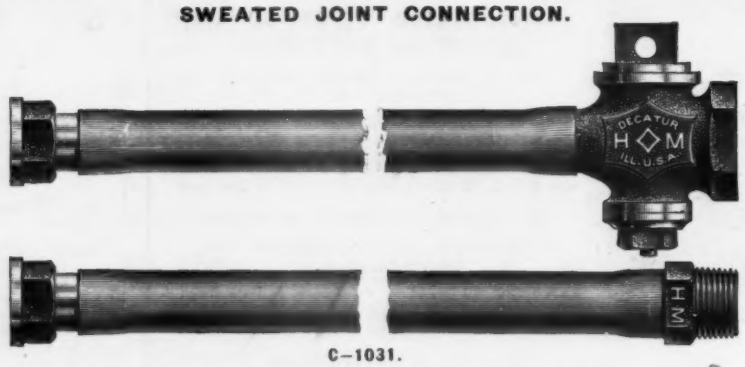
L. C. Co. Catalogue, Sect. 700.

ONLY LICENSED BUILDERS:
Lloyd Construction Co , Detroit, Mich.
Bartlett, Hayward & Co., Baltimore, Md.
Isbell-Porter Co., Newark, N. J.
Stacey Manufacturing Co., Cincinnati, O.

ERNEST F. LLOYD, Patentee,
DETROIT, MICH.

MUELLER GAS METER CONNECTIONS.

SWEATED JOINT CONNECTION.



C—1031.

If fittings are overheated in making sweated joint connections not enough tin will adhere to them to make a firm joint.

In making Mueller Sweated Joint Meter Connections the fittings are heated to a set temperature enough lower than that set for the tin to cause the tin to adhere in a smooth, heavy layer. They sweat firmly into the pipe.

Mueller Sweated Joint Meter Connections are made with special pattern shouldered fittings, sweated into the swedged lead pipe. They are made in 250 sizes and specifications. The connections illustrated have straight meter couplings on one end and a male soldering nipple and meter cock on the other.

Each set of connections is carefully inspected and assembled, is given a 75-pound hydraulic pressure test, bears the Mueller trade mark, and is *unconditionally guaranteed.*

We also make tapping machines and ground key work for gas works' use. Catalogues upon application.

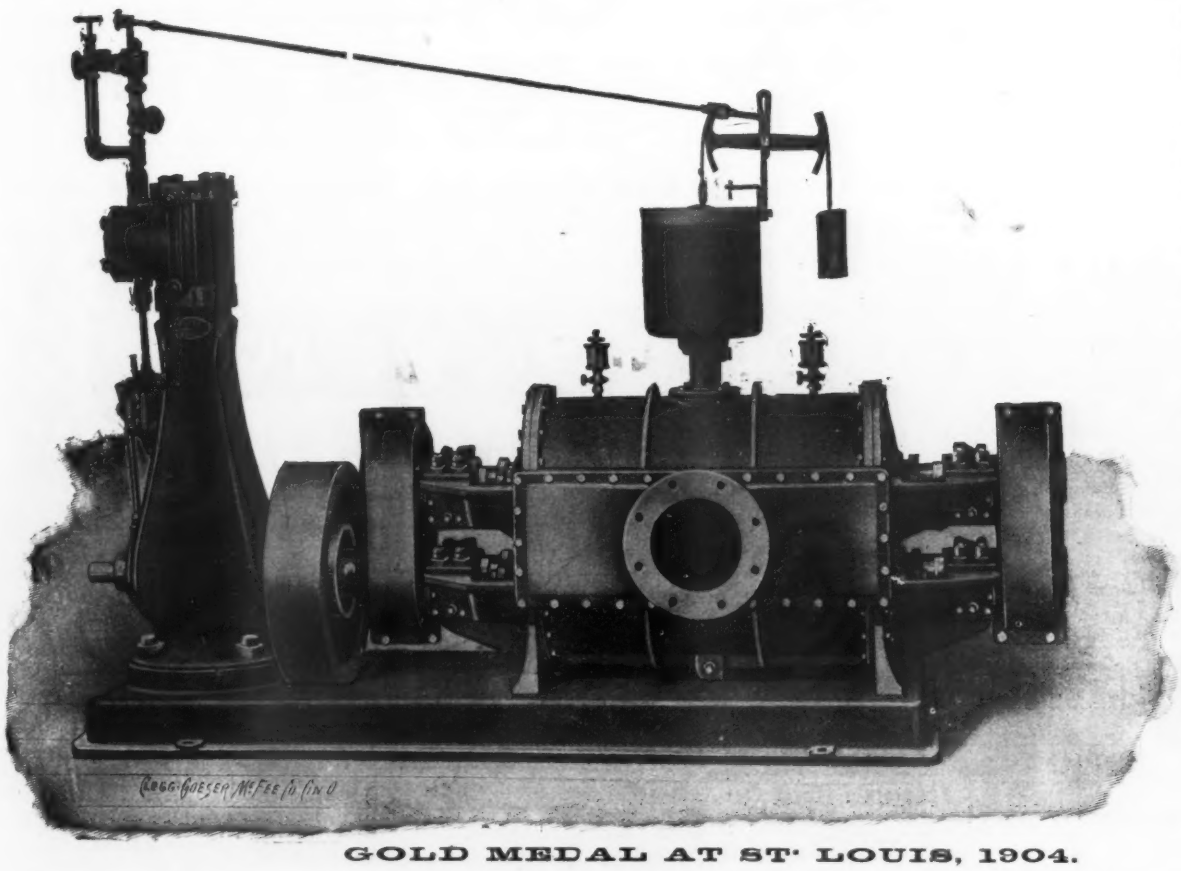
EASTERN DIVISION—Located at 254–258 Canal Street (cor. Elm), New York City, carries a full stock of Mueller goods.

THREE GRAND PRIZES were awarded Mueller Water, Gas and Plumbing goods, respectively, at St. Louis.

H. MUELLER MFG. CO.,

DECATUR, ILL., U. S. A. **NEW YORK, N. Y., U. S. A.**

ROOTS' GAS EXHAUSTERS.



GOLD MEDAL AT ST. LOUIS, 1904.

Sizes for any required capacity.

Self-oiling, adjustable bronze bearings.

Most perfect and sensitive Governor.

Write for Catalogue.

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HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Bldg.

ARTHUR E. BOARDMAN, C.E.,

For several years associated with the late

CAPTAIN WILLIAM HENRY WHITE,

WILL CONTINUE THE BUSINESS OF

CONSULTING ENGINEER

For Gas, Water and Electric Light Companies, at

No. 41 Wall Street, Room 1707, New York.

TELEPHONE, 5534 BROAD.

FRANK D. MOSES,

Telephone, 204-A TRENTON, N. J., Telephone, 204-A

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

CAST IRON GAS & WATER PIPE

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

MUELLER
DRY PIPE TAPPING MACHINES.

C—1008.

Mueller Dry Pipe Tapping Machines, including the Mueller "Regular," "Our Special" and "Our Special No. 2," comprise a line unequal for their class of work They are made strong, are easily attached to the pipe, and are easy to operate under all conditions of use. All dry pipe machines make taps from ⅝ to 3-inch in any size of pipe. Unconditionally guaranteed. Catalogues upon application.

H. MUELLER MFG. CO.,
Decatur, Ill., U. S. A. New York, N. Y., U. S. A.

"THE MINER"
Globe
Street and Boulevard Lamps.
Cheapest and Best
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.
THOMAS T. W. MINER,
821-823 Eagle Av., N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

CHARLES MILLAR & SON CO., Selling Agents, Utica, N. Y.

Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

UTICA PIPE FOUNDRY CO.

Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.

CAST IRON PIPE and SPECIALS FOR WATER AND GAS.

Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :

Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 1668 Park Ave., New York City.

This is No. 2.

Height, 36 inches.
Diameter, 12 "
Shipping weight, 80 lbs.
Net weight, 50 lbs.
The products of combustion are entirely separate from the water. Entire water surfaces are tinned.

Price, $35.00.

HOT WATER

FOR BATHROOM AND KITCHEN

is most easily, quickly and economically supplied by a

Humphrey Crescent Instantaneous Water Heater.

Prices range from $20 to $45.
Every Heater GUARANTEED.

Set a heater for every gas consumer. You will please them and increase sale of gas at the same time.

Send to-day for catalogue and discounts to

HUMPHREY CO.,
Kalamazoo, Mich.,

The only manufacturers in the World of a COMPLETE LINE OF INSTANTANEOUS WATER HEATERS.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

J. F. W. JOST,
CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,
P. O. BOX 2043, PHILADELPHIA, PA.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

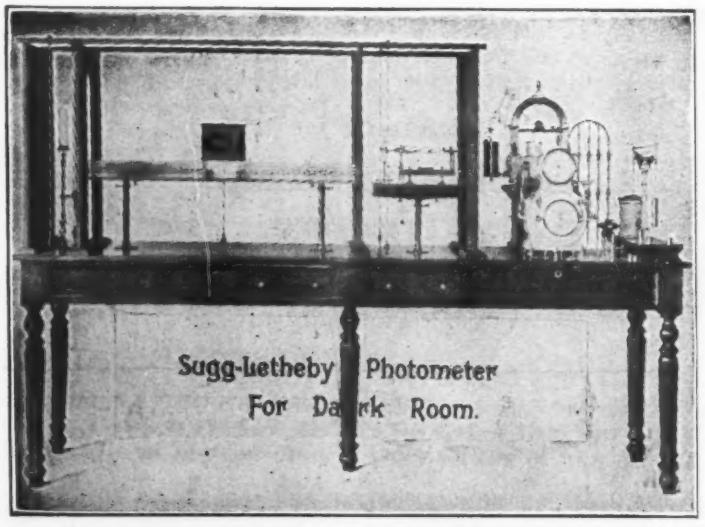
JUNE, 1905.

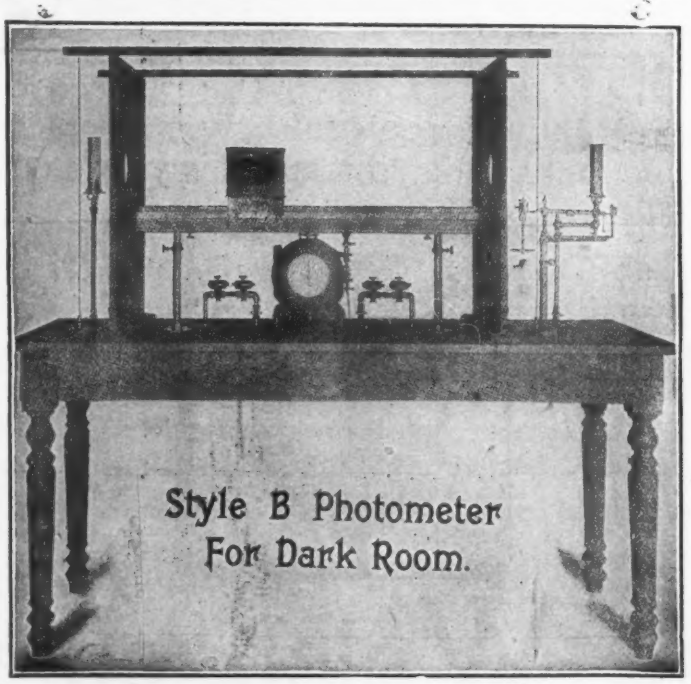
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Thu.	1	7.50 PM	3.30 AM
Fri.	2	7.50 NM	3.30
Sat.	3	7.50	3.30
Sun.	4	7.50	3.30
Mon.	5	7.50	3.30
Tue.	6	7.50	3.30
Wed.	7	10.00	3.30
Thu.	8	10.40	3.30
Fri.	9	11.20	3.30
Sat.	10	11 50 FQ	3.30
Sun	11	12.30 AM	3.30
Mon.	12	1.00	3.30
Tue.	13	1.40	3.30
Wed.	14	2.20	3.30
Thu.	15	No L.	No L.
Fri.	16	No L. FM	No L.
Sat.	17	No L.	No L.
Sun.	18	8.00 PM	9.50 PM
Mon.	19	8.00	10.30
Tue.	20	8.00	11.10
Wed.	21	8.00	11.50
Thu.	22	8.00	12.20 AM
Fri.	23	8.00	12.50
Sat.	24	8.00 LQ	1.20
Sun.	25	8.00	1.50
Mon.	26	8.00	2.20
Tue.	27	8.00	2.50
Wed.	28	8.00	3.20
Thu.	29	8.00	3.30
Fri.	30	8.00	3.30

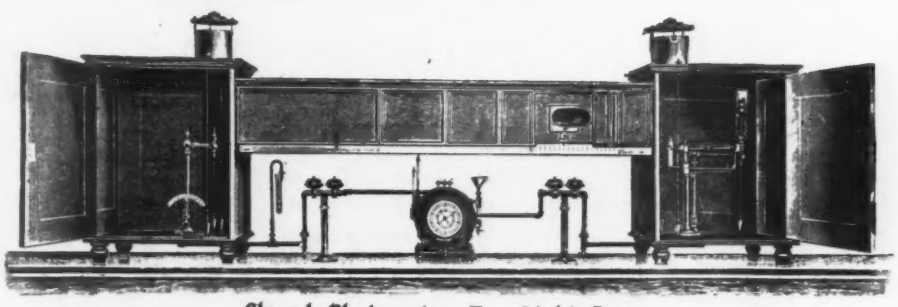
TOTAL HOURS DURING 1905.

By Table No. 1.

	Hrs.Min.
January	240.50
February	192.20
March	207.00
April	175.10
May	161.00
June	139.50
July	149.00
August	161.50
September	173.00
October	205.00
November	211.00
December	229.00
Total, yr.	2245.00







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

JUNE, 1905.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
		P. M.	A. M.
Thu.	1	7.15	3.15
Fri.	2	7.15	3.15
Sat.	3	7.15	3.15
Sun.	4	7.25	3.15
Mon.	5	7.25	3.15
Tue.	6	7.25	3.15
Wed.	7	7.25	3.15
Thu.	8	7.25	3.15
Fri.	9	7.25	3.15
Sat.	10	7.25	3.15
Sun.	11	7.25	3.15
Mon.	12	7.25	3.15
Tue.	13	7.25	3.15
Wed.	14	7.25	3.15
Thu.	15	7.25	3.15
Fri.	16	7.25	3.15
Sat.	17	7.25	3.15
Sun.	18	7.30	3.15
Mon.	19	7.30	3.15
Tue.	20	7.30	3.15
Wed.	21	7.30	3.15
Thu.	22	7.30	3.15
Fri.	23	7.30	3.15
Sat.	24	7.30	3.15
Sun.	25	7.30	3.15
Mon.	26	7.30	3.15
Tue.	27	7.30	3.15
Wed.	28	7.30	3.15
Thu.	29	7.30	3.15
Fri.	30	7.30	3.15

TOTAL HOURS DURING 1905.

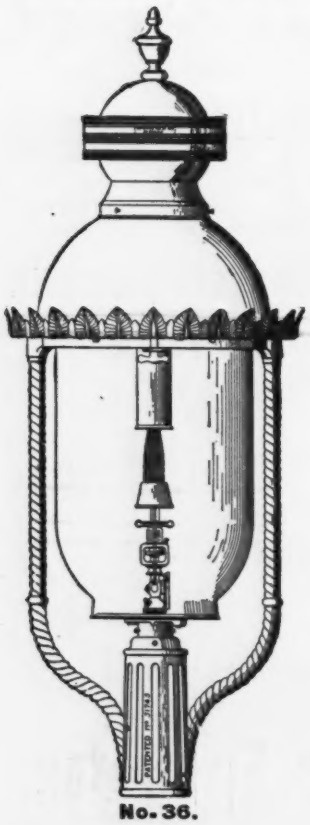
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 57 Liberty Street. BOSTON. 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple---

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31st, 1904, has been Awarded Contracts for 45 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

Harrisburg, Pa.
Pelham, N. Y.
Reading, Pa.
Augusta, Me.
Bangor, Pa.
Woonsocket, R. I. (2d contract).
Brooklyn, N. Y. (4th contract).
Cincinnati, O. (2d contract).
Scranton, Pa. (3d contract).
New York City (14th contract).
New Haven, Conn. (2d contract).
Watertown, N. Y.
Tampa, Fla. (3d contract).
Westchester, N. Y. (3d contract).
Bridgeport, Conn. (2d contract.)
St. Paul, Minn. (2d contract).
Springfield, Mass. (2d contract).
Lynn, Mass. (5th contract).
Rochester, N. Y.
Battle Creek, Mich.
Mechanicsburg, Pa.
Excelsior Springs, Mo.
Bristol, Conn.
Jersey Shore, Pa.
Vicksburg, Miss.

TOTAL SETS, 1904, ... 45
TOTAL DAILY CAPACITY, 1904, ... 56,325,000 cubic feet.
TOTAL SETS TO DATE, ... 553
TOTAL DAILY CAPACITY, ... 419,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF
CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

NATIONAL PYROGRANIT COMPANY,

MANUFACTURERS OF

Fire Brick, Tiles,
Special Shapes, etc.

NEW YORK OFFICE:
17 Battery Place, New York.

WORKS:
South River, N. J.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Established 1846.

Adam Weber Sons.

Manhattan Fire Brick and Enameled Clay Retort Works.

Works at Weber, on the Raritan River, Middlesex County, N. J.

GENERAL OFFICES: Park Row Bldg., N. Y. City.

ERECTION OF

Modern Coal Gas Plants,

With either Horizontal or Inclined Retorts, Half-Depth and Full-Depth Recuperative Furnaces, Adam Weber Patents.

MODERN BENCH IRONWORK.

Linings for Water Gas Apparatus, High Grade Fire Brick of All Descriptions, Ground Fire Clay, Ground Fire Brick in Bulk or Barrels.

ISAAC C. BAXTER, President.
Works.
LOCKPORT STATION, PA.

ESTABLISHED 1864.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Secretary and Treas.
Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis Bldg.,
PITTSBURGH, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick

Price List, f.o.b. BLOOMINGTON, INDIANA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, BLOOMINGTON, IND.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.
Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One to Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street,
Continental Bank,
ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

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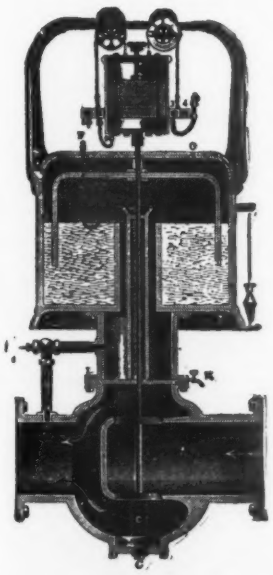

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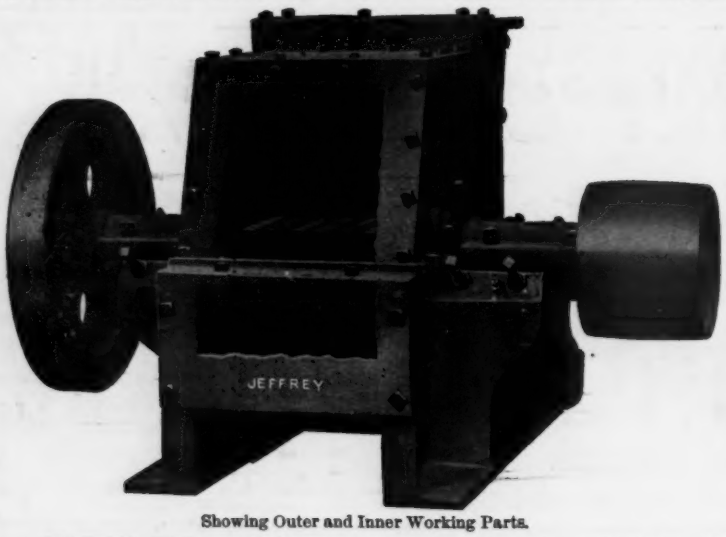

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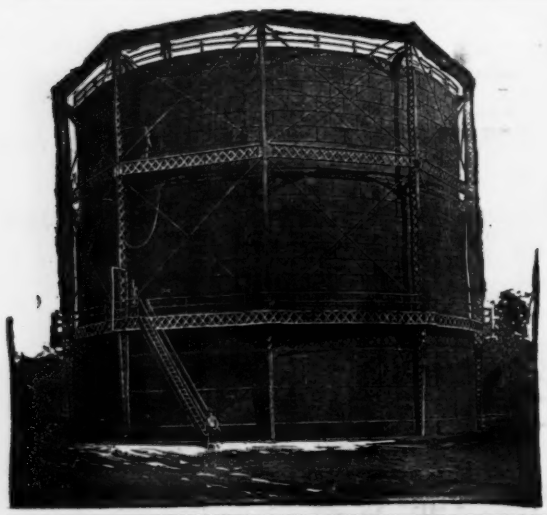

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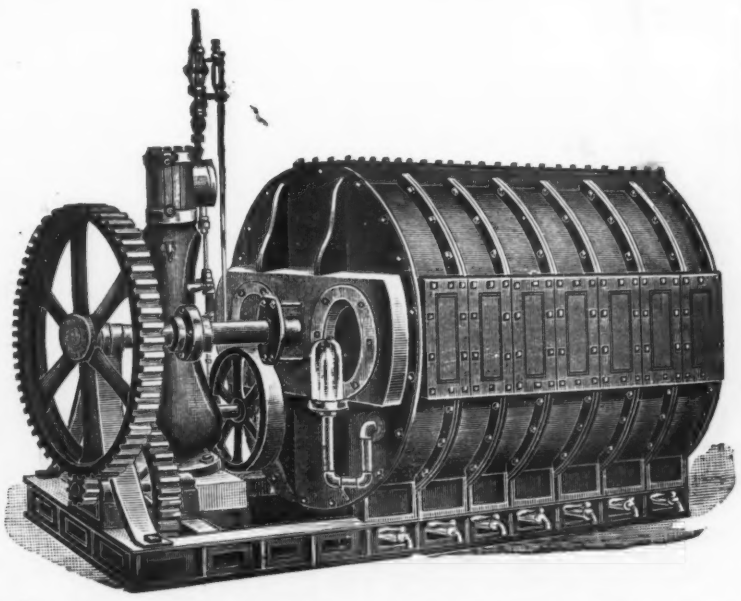

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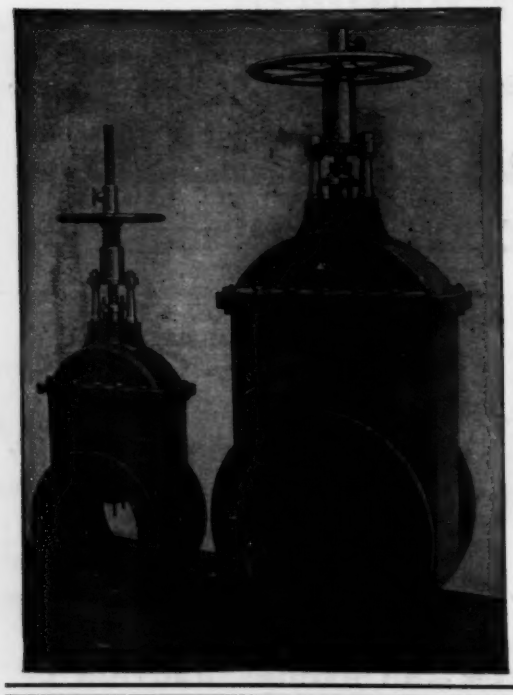

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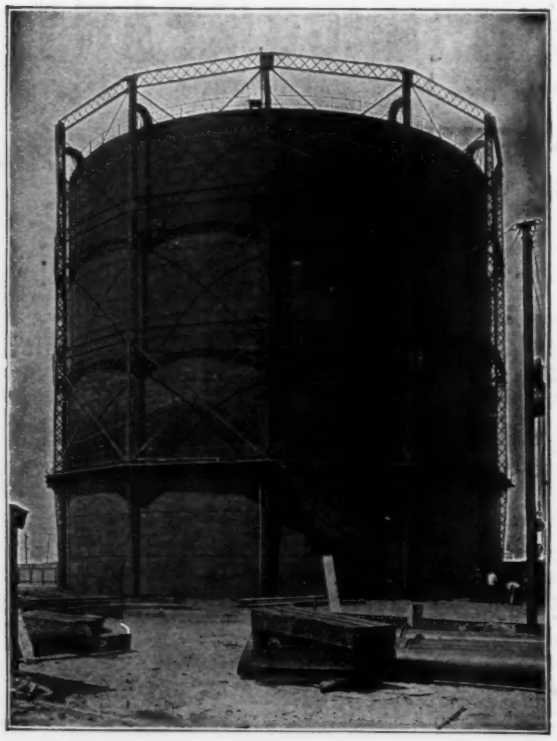

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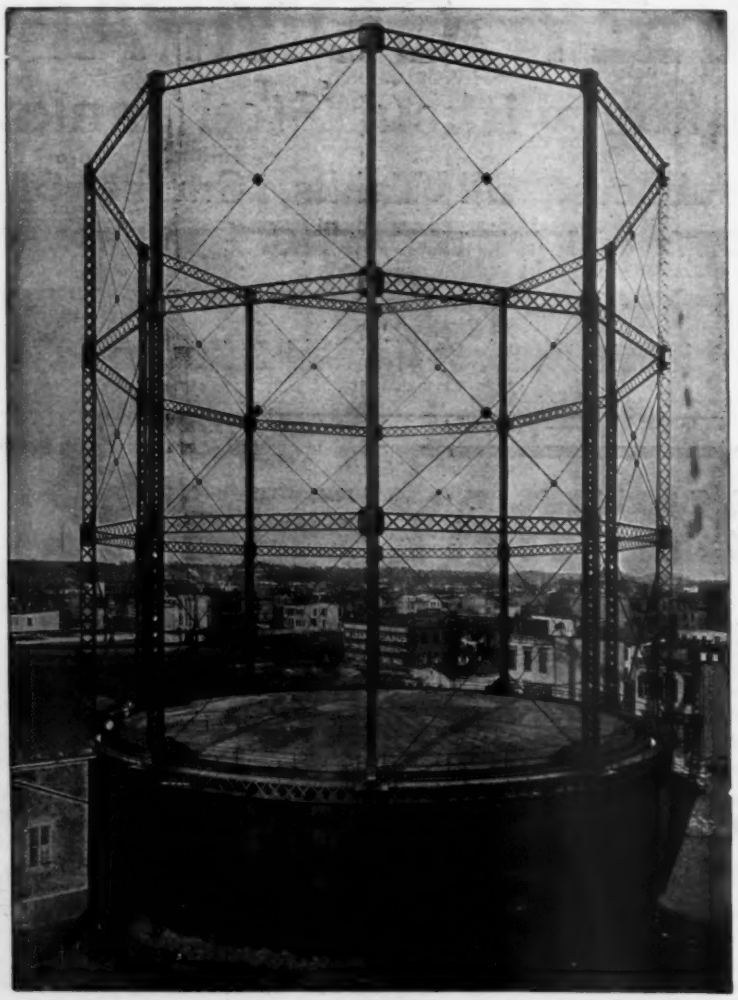

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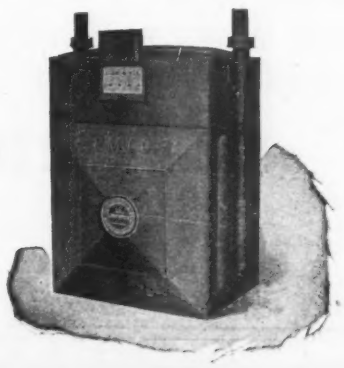

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